Metals Review

The News-Digest Magazine

Published by the American Society for Metals

February 1959

Robert J. Gray
Metallographic Award Winner
(See Article, p. 4)

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Metals Review

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Important Lectures

Departments

Oak Ridge Team Awarded Metallographic Grand Prize

ROBERT J. GRAY, head of the Metallography Section, Metallurgy Division, Oak Ridge National Laboratory, Union Carbide Nuclear Co., Oak Ridge, Tenn., headed up the team of metallographers whose entry took the Grand Prize in the 1958 Metallographic Exhibit held during the National Metal Congress and Exposition in Cleveland. Co-workers on the prize-winning entry included J. C. Gower, W. E. Denny, E. P. Griggs and J. E. Epperson, all from Oak Ridge.

Mr. Gray received his A.B. degree in biochemistry from Sterling College, Sterling, Kan., in 1951. He became interested in metallography in his first post-college position with the Naval Proving Ground in Dahlgren, Va. Much of his interest was generated due to the guidance of W. S. Pellini, now superintendent of the Metallurgy Division, Naval Research Laboratory, Washington, D. C., and B. R. Queneau, now assistant manager of Metals Inspection and Research, Tennessee Coal and Iron Division, U. S. Steel Co., Fairfield, Ala.

In 1946 Mr. Gray became metallographer for American Brake Shoe Co.'s research laboratory in Mahwah, N. J. In 1948 he moved to his present position.

Imitating the growth of the Metallurgy Division at Oak Ridge, under the direction of J. H. Frye, Jr., the Metallography Section, headed by Mr. Gray, is now located in three laboratories and employs 8 technical people, 20 technicians and 1 secretary. In addition to its many supporting research activities for the Metallurgy and other divisions at Oak Ridge, the Metallography Section endeavors to advance the capabilites of metallography through long-range research programs in electron microscopy, hot and cold stage microscopy, dilatometry, vacuum cathodic etching and technique developments in the extraction and identification of inclusions in metal.

In his participation in the Metallographic Exhibits sponsored by A.S.M. at the Annual Metal Show, Mr. Gray served once on the judging committee; he and his associates have won six Best in Class awards; they were awarded the Best in Show Award in 1953 and the Francis F. Lucas award for Best in Exhibit at the Show last year. First-prize awards in "Photomicrographs—Color Prints" and "Electron Micrographs, Metals" were awarded at the A.S.T.M. Photographic Exhibit in Boston in 1958. Color photomicrographs from this laboratory have appeared in *National Geographic, Encyclopaedia Britannica,* and on the July 1958 cover of *Metal Progress.*

Mr. Gray has been a member of the Steering Committee for the Atomic Energy Commission Group on Metallography since 1953 and has served as chairman for the past two years. Last year, he participated in an Oak Ridge-A.S.M. Educational Program and spoke before the Toledo and Philadelphia Chapters on "Metallography and Its Contribution to Metallurgy".

Mr. Gray is a member of Lions International and teaches a men's Sunday School class at the First Baptist Church in Oak Ridge. His hobbies are golf, fishing, woodworking and photography.

R. J. Gray, Head of the Metallography Section, Metallurgy Division, Oak Ridge National Laboratory, Headed Up the Team of Metallographers Whose Entry Took the "Best in Show" Award in the 1958 A.S.M. Metallographic Exhibit. Shown are the members of the team, from left: J. C. Gower, W. E. Denny, E. P. Griggs, Mr. Gray, and J. E. Epperson

Technical Papers Invited for A.S.M. Transactions

The Transactions Committee of the A.S.M. is now receiving technical papers for consideration for publication in the Transactions of the Society and possible presentation before the next national meeting of the Society, to be held in Chicago, Nov. 2 to 6, 1959.

Many of the papers approved by the Committee will be scheduled for presentation on the technical program of the 41st National Metal Congress and Exposition.

Papers may be submitted any time up to Apr. 15, 1959, for consideration for presentation at this convention. The selection of approved papers for the convention technical program will be made in May 1959. Manuscripts may be submitted any time during the year and upon acceptance by the Transactions Committee will be processed immediately for preprinting. All papers accepted will be preprinted and made available to any members of the Society requesting them. However, the printing of an accepted paper does not necessarily infer that it will be presented at the convention. Reprinting of accepted papers is done quarterly; notification of their availability is published in *Metals Review.*

Manuscripts in triplicate, plus one set of unmounted photographs and original tracings, should be sent to the attention of Ray T. Bayless, assistant secretary, American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio.

Should it be your intention to submit a paper, please notify A.S.M. A copy of the booklet entitled "Suggestions to Authors in the Preparation of Technical Papers" will be gladly forwarded. This booklet may help considerably in the preparation of line drawings and illustrations.

Reviews Nickel and Platinum Metals

E. M. Wise, International Nickel Co., Inc., Spoke on the "Metallurgy of Nickel and the Platinum Metals" at a Meeting of Savannah River Chapter. Shown are, from left: Roger Mittleberg, Earl Hoxie, Mr. Wise and George Beckman. (Photograph by George McCaskey for Savannah River)

Speaker: E. M. Wise
International Nickel Co., Inc.

Members of the **Savannah River Chapter** heard Edmund M. Wise, International Nickel Co., Inc., speak on the "Metallurgy of Nickel and the Platinum Metals".

Mr. Wise discussed the processing of the complex ores which provide most of the world's nickel plus substantial quantities of copper, iron ore and cobalt. In addition, a large portion of the world's platinum, palladium, rhodium and ruthenium, plus considerable sulphur, selenium and tellurium, are recovered.

Crushing and grinding, followed by selective flotation and magnetic separation, provide the main products which are worked up to provide nickel, copper and iron. Sulphur is removed by oxidation and, in the case of the copper sulphide fraction, this is done by flash smelting in pure oxygen to yield concentrated SO_2 which is recovered. The oxygen for this operation is produced in one of the world's largest atmospheric oxygen plants. The nickel sulphide is converted into a matte which is very slowly cooled and given additional treatment to remove most of the copper and the platinum metals. The nickel sulphide is then converted into nickel oxide sinter as well as other nickel products.

Mr. Wise then proceeded to show how the electrical, magnetic and corrosion resisting properties of nickel, plus its well-known effect on structural transformation in steels, were utilized. Effects such as magnetostriction, which might seem academic, are the basis of substantial tonnage uses for nickel and, indeed, are responsible for the low-expansion and constant modulus properties obtainable in the nickel-iron-base alloys. The wide variety of properties is the basis for the use of nickel in the electron tube industry while the high permeability of the nickel-iron alloys, such as Permalloy, is required for communication equipment, magnetic shields and memory devices and a host of other electronic specialties. Alnico, originally devised by Mishima and improved by Dutch and American metallurgists, revolutionized the concept of permanent magnets in industrial devices.

The effect of nickel on the transformation of steel has been fully exploited in producing 300-M steel yielding a tensile strength as high as 300,000 lb. coupled with a high yield point and substantial ductility. Similar strengths have been obtained by cold working the 18-8 stainless steel alloys at temperatures of minus 200° F. followed by heat treatment at about 800° F. The percentage of platinum in International Nickel Co.'s alloys is of the order of the radium content of pitchblende, roughly a part in a million, but the recoveries are almost quantitative. Platinum has found its major use in industry as a corrosion and heat resisting material. Its use is responsible for the production of fiber glass as well as the world's nitric acid and most of the perchlorates. In the last few years, large quantities have been demanded to produce higher antiknock gasoline. Palladium finds its largest use in electrical contacts in the telephone system and roughly a billion such contacts were made last year. This is probably more than all of the other contact materials used in the low-current field. Rhodium is an essential alloying element with platinum for thermocouples, catalysts and glass handling equipment. Rhodium is also readily electrodeposited to produce a very white corrosion resisting surface, which is employed not only for appearance purposes, but also for electrical contact service. Iridium and ruthenium are principally used for hardening the other platinum metals. A recent development is the use of platinum surfaced anodes for the impressed current method of corrosion prevention on ships as well as small motor boats.—**Reported by L. P. Costas for Savannah River.**

Discusses Magnesium Castings

K. E. Nelson, Metallurgical Development Section, Dow Chemical Co., Reported on the "Metallurgy of Magnesium Castings and Forgings" at Notre Dame. He discussed magnesium and its alloys, methods of preparation and application in castings and forgings. Shown are, from left: George Feterston, vice-chairman; C. Needled, Penn Township School; Mr. Nelson; Mr. Dickey, South Bend Schools; and W. Chandler, Notre Dame University

Describes Use of Magnesium in Aircraft

R. S. Busk, Dow Chemical Co., Presented a Talk on "Magnesium Alloys for Aircraft and Missile Applications" at a Meeting Held in Boston. Shown are, from left: W. A. Backofen, technical chairman; Dr. Busk; and R. A. Pomfret, chairman. (Photograph by H. L. Phillips for Boston)

Speaker: R. S. Busk

Dow Chemical Co.

R. S. Busk, director, metallurgical laboratory, Dow Chemical Co., presented a talk on "Magnesium Alloys for Aircraft and Missile Applications" at a meeting in **Boston.**

Some of the more important properties required of magnesium alloys for aircraft and missiles are stability (as measured by strength-weight ratio), corrosion resistance and reliability. Slides were shown of the various types of aircraft in which magnesium alloys are used in the form of sheet, extrusions, forgings and castings. Sizable quantities are used in missiles.

With the aid of slides, Dr. Busk showed various types of aircraft, the speed of operation and the increase in skin temperature with the increase in speed. He explained that for equilibrium conditions, the skin temperature is a function of speed and height of travel. However, for short life, conditions of nonequilibrium exist since the time and number of missions decrease with an increase in skin temperature. For nonequilibrium rather than equilibrium conditions, factors of specific heat, thermal conductivity and density become important. The physical constants for magnesium are such that a magnesium structure will not get as hot in some missile service as an equivalent steel structure.

Work on magnesium alloys for elevated temperature service started about 20 years ago. As time went on, the important and unique role of rare metals, particularly thorium and cerium, was observed. A study was made of their effect on properties. More recently, the development of the rare-earth magnesium alloys included the addition of zinc and zirconium, the latter element being added for grain refinement.

Most magnesium alloys do not have a well-defined yield point; however, there are a few exceptions to this.

The Mg-Al-Zn ternary alloys are only useful at operating ranges up to 300° F. and the Mg-rare earth alloys with zirconium added are useful from 300 to 450° F. The newer magnesium-thorium alloys are applied at temperatures as high as 700° F. The newer high-temperature alloys of magnesium have been developed for high Mach operation. Of the more prominent alloys, recently developed, are HK31A, HM21A and HM31A, which are obtainable as sheet, extrusions and castings.—**Reported by Stephen G. Demirjian for Boston Chapter.**

Welding Metallurgy of Stainless Steel Is Topic

Speaker: G. E. Claussen

Linde Co.

Members of the **Chattanooga Chapter,** in a joint meeting with the Chattanooga Chapter of the American Welding Society, heard G. E. Claussen, Linde Co., speak on "Welding Metallurgy of Stainless Steel".

The speaker first illustrated what is meant by the term stainless steel and explained why it is stainless. He showed the function of chromium oxide in resisting oxidizing corrosion and of nickel oxide in resisting reducing-type corrosion. He then outlined the various grades of stainless steels such as the austenitic types of high-chromium and nickel and the high-chromium irons without nickel which are used in kitchenware and cutlery, the last containing about 1% C.

Discussing the role of carbon and carbides in stainless steel, Dr. Claussen described how they act and illustrated the trouble that carbon as carbides can cause in loss of corrosion resistance if not handled correctly. He then showed how the carbon can be stabilized by the use of columbium and proper heat treatment.

Although the higher alloy grades of stainless are austenitic, about 5% of ferrite is necessary in weld metal to keep down hot cracking. Another type of cracking illustrated was "fingernail cracking" which may take place in stabilized steel adjacent to the weld in the heat affected zone in exceptionally severe corrodents.

In his discussion of the welding of stainless steel, Dr. Claussen advised the use of low welding heat and small stringer beads for fully austenitic material.—**Reported by J. H. McMinn for Chattanooga.**

Speaks in York on Aluminum

"Applications of Aluminum" Were Discussed at a Meeting of York Chapter by P. Brandt, Reynolds Metals Co. Shown are, from left: R. C. Smith, meeting manager; Mr. Brandt; H. A. Clopper, coffee speaker; J. A. Nielson and M. J. Rife, meeting managers. (Reported by N. Stengel for York)

Meet Your Chapter Chairman

MAHONING VALLEY

KARL L. FETTERS, assistant vice-president of Youngstown Sheet and Tube Co., is a native of Alliance, Ohio. He is a graduate of Carnegie and Massachusetts Institutes of Technology and holds B.S. and Ph.D. degrees in metallurgical engineering. He joined Youngstown Sheet and Tube about 1936 as openhearth metallurgist. Two years later he left to spend a year as research assistant and another year as National Openhearth Fellow at M.I.T. Dr. Fetters was also assistant professor and staff member of the Metals Research Laboratory at Carnegie Institute, in charge of the office of Scientific Research Development project on seamless gun tubes. He returned to Youngstown in 1943 as special metallurgical engineer and was appointed assistant to the vice-president on the staff of the operating vice-president; later he was appointed assistant to the vice-president in charge of operations before assuming his present position in 1956.

Many articles by Dr. Fetters have been published in various technical publications. In 1948 he and J. L. Mauthe, now board chairman of Youngstown Sheet and Tube Co., received the American Iron and Steel Institute medal for their paper on "The Mineralogy of Basic Openhearth Slags".

Chapter activities include serving on the National Educational Committee (chairman for one year) and several nominating and other special committees. He served a two-year term as a National Trustee and represented A.S.M. at the joint Metallurgical Conferences in Europe in 1955.

When the Mahoning Valley Chapter established the Marcus A. Grossman Lecture, Dr. Fetters was chosen to be the first lecturer. A member since 1935, he has also been with the Cleveland, Pittsburgh and Boston Chapters.

For recreation he and his two sons, Craig, 16, and James, 13 years old, enjoy boating. He is active in the U.S. Coast Guard Auxiliary and as a District Radio Communications Officer for the U.S. Power Squadron. He is also a member of Tri-City Yacht Club of Vermilion and Great Lakes Cruising Club.

SPRINGFIELD

ROGER H. HEROUX has been a member of A.S.M. for eight years, has held all offices of the local chapter, and is active in other technical and civic societies. He served in the U. S. Army for ten years, four years on active duty in the European theater, taking part in the invasion of Normandy. He received a battlefield commission and was relieved of active duty with the rank of captain. First civilian work was as inside salesman for A. G. Spalding & Bros., and he is now technical service representative for Oakite Products, Inc., New York City.

Roger enjoys home gardening and is president of the Longmeadow Square Dance Club. He is studying piano and teaches Sunday school, so with his family of three girls, 12, 8 and 4 years old, he has no problem of what to do with his spare time.

CANTON-MASSILLON

WILBERT W. SCHEEL was born in Zelienople, Pa., and is a graduate of Pennsylvania State University where he received a B.S. degree in metallurgy. His first position after college was with DuPont, Remington Arms Division, before joining the metallurgical staff of Republic Steel Corp. in Canton. Since that time he has been engaged in research metallurgy, field service engineering and production control metallurgy. He is now plant metallurgist for the South Plant of Republic. He is also on the speaker's staff of the Corporation and has delivered his very interesting talk on "Titanium" to many organizational groups.

Bill is married and has two sons, Steven, 3 years, and Joseph, 2 years old. His sports interests are golf and tennis, and his hobby is woodworking to a useful purpose.

LOS ALAMOS

WILLIAM W. MARTIN, a native of Washington, D. C., is presently an assistant group leader at Los Alamos Scientific Laboratory, where he is concerned with the development and production of materials peculiar to the nuclear field.

Since receiving his B.S. degree in metallurgy from Carnegie Institute of Technology he has had experience in blast furnace and arc furnace operation, heat treatment, process engineering and metallurgical research. He is a member of the American Nuclear Society, Tau Beta Pi and Phi Kappa Phi. A veteran of 22 years in A.S.M., he has held all elective offices in the Los Alamos Chapter.

An ardent sportsman, Bill enjoys hunting, fishing, organized league bowling and participation in Little League baseball activities. He has three sons, 9, 12 and 15 years old.

PHOENIX

RALPH L. FISCHER comes from Plymouth, Mich. He has a B.A. degree in science from Albion College and a B.S. in mechanical engineering from University of Michigan. Upon graduation he received a commission as ensign and served in the Mediterranean area for three years. He is now a lieutenant in the U. S. Naval Reserve. First civilian employment was as a welding engineer and later as methods engineer while in the east. He is now process engineer of AiResearch Manufacturing Co. of Arizona. Activities in the chapter include the offices of secretary, treasurer and vice-chairman. He is also a member of the Arizona Council of Engineering and Scientists and Elks Lodge.

Mr. Fischer is married and has three children. Other interests are St. Theresa Holy Name Society and the AiResearch Bowling League.

W. W. Scheel

R. L. Fischer

K. L. Fetters

R. H. Heroux

W. W. Martin

Describes Trip to Russia

F. M. Rich, General Manager, Inland Steel Co., Presented Some "Observations of the Soviet Steel Industry" at a Meeting in Calumet. He is shown, left, with E. K. Phares, chairman of the Calumet Chapter

Speaker: F. M. Rich

Inland Steel Co.

"Observations of the Soviet Steel Industry" was the subject of a talk given by F. M. Rich, general manager, Inland Steel Co., at **Calumet.**

Mr. Rich was a member of the first group of American steelmen to visit the Soviet Union under the recent plan of cultural and economic exchange programs. In a three-week tour covering 8000 miles by plane, train and automobile, the group visited six steel centers and six "cultural" centers, obtaining an enlightening view of the steel industry and the life of the Russian people.

The people were friendly and anxious to make a favorable impression upon the visitors. The country, as a whole, was described as drab, clean of litter, but muddy. The people dress poorly by U. S. standards and must work 7 to 27 times longer than an American to purchase clothing. Housing is in short supply and completely regulated by the government.

Production is the main theme of the Russian steel industry. Although the industry has about a one-third larger working force than we have, it suffers from a manpower shortage. (Women make up about one-third of the working force.)

Several methods of motivation help production. Wages vary according to the job, and bonuses are given for meeting quotas set by Moscow, additional bonuses being given for going over the quota. Other types of recognition, such as newspaper and billboard publicity of quota-topping workers, the Stalin award and expense-paid vacations, are a few of the motivating factors. According to Mr. Rich, the communists are every bit as capitalistic as we are in respect to individual incentive pay.

At present, 60% of Russian production is in the form of structural and bar stock which goes mainly into capital goods, industrial expansion and military facilities, as compared to 23% in the U. S. However, it is doubtful if much of their finished steel would be of satisfactory quality in our competitive market.

The Russians hope to achieve a production of 125 million ingot tons by 1975. They may some day be producing in such quantity that they could sell steel anywhere in the world for transportation costs and thus make themselves seriously felt in international economics. Factors which would enable them to become strong economic competitors include motivations and incentives for production, abundant raw materials and hard-working, intelligent people. They lack religious faith, the right to acquire and own property and a multiparty political system.

Mr. Rich suggested the following steps to prepare for active competition from the soviet steel industry:

1. Encourage cultural and economic exchanges to show as many Russian people as possible what kind of people we are and that our standard of living is higher than theirs.
2. Stop reducing the purchasing value of our dollar by:
   a. Limiting wage increases to amounts justified by productivity increases.
   b. Balancing the federal budget by reducing government spending.
3. Reverse the trend toward centralization of government by putting more authority back into the hands of state and local governments.
4. Overhaul our tax system to make more "venture" capital available.
5. Encourage and expand research.
6. Use every means we can to show the Russians how our people are strengthened by religious faith and our right to worship God as we see fit.—**Reported by R. D. Engquist for Calumet.**

Discusses Stress Relief

R. T. Myer (Left), Kaiser Aluminum & Chemical Corp., Who Spoke on "Aluminum Distortion Relief by Stretch Method" at a Meeting Held Recently by the Los Angeles Chapter, Is Shown With Chairman John Wilson

Speaker: R. T. Myer

Kaiser Aluminum & Chemical Corp.

Members of the **Los Angeles Chapter** heard R. T. Myer, metallurgical manager, Kaiser Aluminum & Chemical Corp., speak on "Aluminum Distortion Relief by Stretch Method". This topic is increasing in importance because of the expanding use of the larger, closer tolerance, single-piece sections now being produced for the airframe manufacturers.

Stretch stress relief is a process by which aluminum plate is permanently stretched 2%. New stretchers (capable of 30,000,000 lb. pull) are planned which will allow ingot plate with a cross section of 15 x 64 in. to be stretched. Simple flat die shapes are reduced in thickness 2% and closed die forgings, because of their shape, usually have the 2% cold reduction on certain areas only. Internal stresses introduced by casting, rolling and forging do not present a problem and stresses from quenching and straightening can be helped by stretch stress relieving.

The mechanical properties resulting from this process indicate slightly higher yield points with only a slight drop in tensile strength.—**Reported by T. J. Simms for Los Angeles Chapter.**

Nuclear Conference Set

The 1959 Nuclear Congress and Atom Fair, managed by Engineers Joint Council and sponsored by some 30 American engineering and industrial societies and associations, is to be held at Cleveland Public Auditorium the week of Apr. 5. Two or three simultaneous sessions will be held each day in order to consider the 128 papers submitted on all aspects of the industrial use of atomic energy. Sessions on metallurgical aspects will be held on Wednesday afternoon and Thursday. A series of discussions will also be held Tuesday to Thursday on Hot Laboratories, wherein some 70 additional papers in this area will be presented.

Outlines Unusual Corrosion Problems

M. G. Fontana (Left), Ohio State University, Who Spoke on "Unusual Corrosion Problems" at Dayton, Is Shown With Chapter Chairman W. J. Ridd

Speaker: Mars G. Fontana
Ohio State University

Members of the **Dayton Chapter** heard Mars G. Fontana, chairman, metallurgy department, Ohio State University, speak on "Unusual Corrosion Problems" at a recent meeting.

Prior to the meeting, several of the members toured the plant and laboratories of the Duriron Co., which makes corrosion resistant pumps, valves and other products from stainless and silicon-iron alloys.

Dr. Fontana's presentation concerned the corrosion problems associated with off-shore oil and gas wells in the Gulf of Mexico. These are the stable off-shore platforms that rest on pilings driven into the ocean floor. Originally the off-shore platforms were intended to be temporary, and few precautions were taken to protect them from the severe action of the salt water. Later the oil companies involved changed their views and were anticipating as much as a 50-year life for the platforms. This meant that new and replacement platforms must have a "cleaner" design for ease of removal of corrosion products. Criss-crossed angle-iron supporting members were difficult to clean properly. A new design using large diameter tubing with smooth connections facilitated this cleaning problem.

The supporting members completely beneath the water level could be protected by magnesium anodes hung in the water. Another method to afford galvanic protection is to use non-dissolving anodes such as Duriron, and to impress an outside current on these anodes. In both methods the anode has to have an electrical connection with the rest of the structure so that the underwater members will be the cathode and corrosive attack will be retarded.

The structural members completely above water, and the top or platform part of the unit, are the least difficult to protect. Painting is usually satisfactory, but of course the maintenance on these areas must be continuous.

The most troublesome locations from a corrosion viewpoint are the structural members in what is called the "splash zone". This is the relatively few feet where wave action alternately wets the metal and then allows air to contact it, with a resulting high corrosion rate. Wave action makes painting difficult, and makes paint ineffective as a protective agent. Galvanic protection is also ineffective in the splash zone. Shielding of this area with a relatively inert material such as concrete offers the most promise. Very good results have been obtained on some platforms by using Monel shields wrapped around the structural members so that the splash zone was completely covered.

Dr. Fontana listed interesting examples of corrosion within a well casing itself. All of his examples concerning corrosion as well as the off-shore platforms were illustrated with a number of interesting slides. —**Reported by D. M. Ashfal for Dayton Chapter.**

Describes Metals for High Temperatures

From Left: G. W. Beckman, Chairman, H. R. Ogden, Division Consultant, Battelle Memorial Institute, and R. F. Mittelberg, Technical Chairman, Are Shown During a Meeting of Savannah River Chapter. Mr. Ogden presented a talk on "New Metals and Alloys for High-Temperature Applications"

Speaker: H. R. Ogden
Battelle Memorial Institute

H. R. Ogden, division consultant, Battelle Memorial Institute, spoke on "New Metals and Alloys for High-Temperature Applications" at a meeting of **Savannah River.**

The emphasis today in the materials of the construction field is on materials for high-temperature, high-stress applications. Specific applications include space vehicles, missiles, satellites, high Mach number aircraft, and jet and rocket motors. The metallic materials of interest are the high melting point refractory metals, columbium, tantalum, chromium, molybdenum and tungsten. Other metals with high melting points would be of interest except for their scarcity and high cost.

Maximum service temperatures for the refractory metals are presently in the range of 0.4 to 0.5 of the absolute melting temperature. Significant increases in strength, ductility, oxidation resistance and service temperature are expected through alloying. Coatings may be used to protect the metal in the immediate future.— **Reported by R. P. Marshall for Savannah River.**

Surveys Soviet Industry

P. E. Cavanagh, Premium Iron Ores Ltd., Spoke on "Russian Metallurgy" at a Meeting in Montreal. He is shown (right), with H. H. Yates, vice-chairman

Speaker: P. E. Cavanagh

Premium Iron Ores Ltd.

Members of the **Montreal Chapter** heard a talk on "Russian Metallurgy" by P. E. Cavanagh, vice-president, Premium Iron Ores Ltd., who has made two recent trips to Russia.

Mr. Cavanagh reported that he was allowed to move about as freely in Russia as he does in Canada. Since his primary interest was iron ore concentration, this phase of soviet steelmaking was explained to him in detail. He attended meetings in Leningrad where six rival teams of engineers and technicians discussed the relative merits of six different methods of ore concentration. According to Mr. Cavanagh, the Russian people are proud of their accomplishments and are ready to show outsiders what they are doing. One reason for this is that a few years ago they had very little—now they are eager to display the results of their rapid progress.

In speaking on the Russian educational system, Mr. Cavanagh pointed out that a Russian professional man receives ten times the salary of non-formally trained workers, which is a much larger income ratio between university trained people and non-technically trained people than in Canada. Some leading soviet technical men earn three to four times what their American counterparts do. This monetary factor, plus the very strong element of prestige associated in Russia with university attendance, has resulted in fierce competition for enrollment in the schools. However, because of the large population and still inadequate teaching facilities, college entrance requirements are very high. For instance, candidates for metallurgical engineering degrees must maintain 85% grades in their high-school studies before even being considered by the university admissions committee. In 1957, one out of every six applicants for metallurgy was admitted.

The soviet industry's technical literature is now accurate and trustworthy, Mr. Cavanagh stated. They are vitally concerned with plotting progress. Technical data, both domestic and foreign, is widely distributed throughout the country. Not too long ago, 22,000 people were employed in Moscow turning out reproductions of foreign publications in great quantity for redistribution to interested people. Now that Russian technology has closed the gap between itself and Western technology, this type of plagiarism has been curtailed.

Mr. Cavanagh mentioned that the Russian boast of high production has a foundation in fact. For example, one United States steel mill had reported of a blast furnace output of 2250 tons of steel per day. At the same time, the Russians had four furnaces turning out as high as 2500 tons per day, and one produced 2700 tons per day. This production rate characterizes their steelmaking processes where some openhearths are overcharged by 20% of rated capacity to increase production.

The steel industry in Russia is reported as being organized along the lines of U. S. Steel Corp. All the installations are units of one big operation, centrally controlled. The Russians have made good use of new foreign ideas and methods, sometimes even more successfully than the initiators. A case in point is illustrated by the fact that the Russians are now using self-fluxing sinter in ironmaking, a method adopted from Swedish practice.

They are now rolling ladle degassed good quality silicon sheets which took them only three years to develop. They have made great advances in pipe and tube mill operations, and they are now producing a thinner Permalloy sheet than the West. They are helped by the unlimited guidance of government-controlled laboratories which combine the functions of laboratories and consulting engineering firms in the U. S. and Canada.

Mr. Cavanagh remarked in closing that instead of threatening one another, the Western and Russian politicians and diplomats would do better to take a cue from their scientists and technical men and get together only to compare intelligent ideas.—**Reported by H. H. Mays for Montreal.**

Lorig Guest at New Jersey

Then President-Elect C. H. Lorig (Left), Who Spoke on "Selection of Materials", Is Shown at a New Jersey Chapter Meeting With Chairman J. L. Everhart

Outlines Fundamentals Of Wear and Friction

Speaker: E. M. Kipp

Foote Mineral Co.

E. M. Kipp, director of research and development, Foote Mineral Co., discussed "Fundamentals of Wear and Friction" at **Philadelphia.**

The speaker outlined the many variables involved in the friction and wear process. A great deal of basic knowledge must be acquired to develop a comprehensive theory to satisfactorily describe the friction and wear process. The frictional force may be attributed to the work necessary to overcome the plowing effect of the asperites on the rubbing surfaces, the energy required to lift these asperites over one another, or the work required to shear many minute welds formed at the actual points of contact.

Dr. Kipp stated that to produce a general theory of wear applicable under all conditions, a fundamental understanding of these variables and their relative importance under given operating conditions must be developed. For example, under full hydrodynamic lubrication, the load, speed, geometry and properties of the lubricant must be accurately evaluated to obtain a meaningful picture of the operation.

Slight surface finish variations are important under the severe conditions encountered during rolling or other metalworking operations. The actual surface roughness may be less important than the process used to obtain a given degree of finish. Distinct variations in the frictional behavior of surfaces with the same roughness number, but processed under different techniques, have been observed. He stressed the need for a cooperative program, involving the fields of metallurgy, chemistry and physics, to study the problems of friction and wear.—**Reported by N. J. Petrella for Philadelphia.**

Metals in the Auto Industry

Shown at a Meeting of Mahoning Valley Chapter Are, From Left: Ralph Skerratt, Jr., Technical Chairman; Joseph Gurski, Ford Motor Co., Who Spoke on "Nonferrous Metals in the Automotive Industry"; and Otto Turnovsky, Secretary-Treasurer of the Chapter

Speaker: Joseph Gurski
Ford Motor Co.

Approximately 75 members of the **Mahoning Valley Chapter** heard Joseph Gurski, manager of the laboratory services department, Ford Motor Co., speak on "Nonferrous Metals in the Automotive Industry".

Mr. Gurski stated that increasing amounts of nonferrous metals are being used in the manufacture of automobiles. Presently, about 5% of the materials consumed are nonferrous.

Copper is a popular nonferrous metal in this industry primarily because of its high electrical conductivity, high thermal conductivity and excellent corrosion resistance. Radiators and electrical wires are prime examples of its usage.

Aluminum and its alloys are in widespread use for such applications as decorative trim and in automatic transmissions. Aluminum's attractive properties of appearance, corrosion resistance and light weight promise even greater use in the future. It is being considered as a possible substitution for copper and brass in the manufacture of radiators; however, the difficulty encountered in joining and problem as to how adequate its corrosion resistance is have slowed its use.

Mr. Gurski then described die castings and their advantages, disadvantages and the important role they play in the auto industry. Aluminum and some magnesium die castings are used for many applications because of their light weight and strength, whereas zinc die castings are generally used because they are easy to bright plate.

Mr. Gurski also discussed the evolution in decorative metals for the automobile. Originally, buffed copper-base alloys were used for decoration. Nickel-plated steel, buffed to a high luster, replaced brass, and presently, electroplated bright nickel overlayed with chromium is being used for this application. Nickel with or without underlayers of copper provides corrosion resistance to parts, and the thin layer of chrome provides brightness and resists tarnish.

Mr. Gurski emphasized that because of extreme competition in the auto industry, once the engineering requirements are met, costs determine which metal will be most used. He described how a part costing one cent more per auto amounts to thousands of dollars in extra cost annually when the total number of cars produced is taken into consideration. **—Reported by E. J. Fromm for Mahoning Valley.**

Vacuum Melting Reviewed

A. M. Aksoy, Crucible Steel Co. of America, Presented a Talk on "Vacuum Melting Processes" at a Meeting of Mahoning Valley Chapter. Shown are, from left: Clark Dawes, technical chairman; Dr. Aksoy; and J. G. Cutton, vice-chairman of the Chapter

Speaker: A. M. Aksoy
Crucible Steel Co. of America

Over 50 members of the **Mahoning Valley Chapter** heard a talk by A. M. Aksoy, manager, Applied Research Laboratory, Crucible Steel Co. of America, on "Vacuum Melting Processes and Properties of Vacuum Melting Alloys".

Dr. Aksoy recently visited Russia at the invitation of the Academy of Science of the USSR to participate in a conference on vacuum metallurgy.

Dr. Aksoy said that recent technological advances have increased the demands for new or improved alloys with better properties. One of the most significant developments toward the fulfillment of these requirements in recent years has been vacuum melting. At present, there are three major processes: vacuum induction melting; vacuum arc remelting; and vacuum degassing.

Basic principles and limitations of these processes were presented. The talk dealt primarily with quality aspects—composition, cleanliness, segregation, etc.—and properties—stress rupture life, ductility, fatigue, impact, etc.—vacuum induction melted and vacuum arc remelted superalloys and steels. Dr. Aksoy compared these properties with those of air melted material. Double vacuum melting, first induction and then arc, was also discussed.

The vacuum induction melting process is used for the production of high-quality products relatively small in size and where composition control is essential. The vacuum arc remelting process is most suitable for large forgings in which sound centers and freedom from segregation are required and also for quality products of less critical nature. For the ultimate in quality of product, double vacuum melting is used. Dr. Aksoy presented a series of slides to illustrate his talk. **—Reported by E. J. Fromm and R. H. Rein for Mahoning Valley.**

Speaks on High-Purity Tungsten at Missouri

Speaker: Vernon A. Nieberlein
U. S. Bureau of Mines

At a meeting at **Missouri School of Mines and Metallurgy,** Vernon A. Nieberlein, United States Bureau of Mines, spoke on "High-Purity Tungsten". Mr. Nieberlein reviewed the work done at the Bureau of Mines station in Rolla, Mo., which is just one phase of a program being carried out at several stations.

Pure tungsten is obtained by thermal decomposition of tungsten hexafluoride on the walls of a copper-tube furnace. The metal deposited inside the tube is then recovered by dissolving the copper tube in acid. Tungsten, produced in this manner, has been made in resulting cylindrical shapes weighing about 1 lb. The tungsten obtained is of a very high purity and has a specific gravity significantly lower than that obtained in earlier work.

The speaker supplemented his talk with photomicrographs of the metal produced and samples of the pure tungsten as obtained from the furnace.—**Reported by Donulus J. Padberg for Missouri School of Mines and Metallurgy.**

Describes Selection of Mold Steels

George J. Schad, Sales Metallurgist, Carpenter Steel Co., Spoke on "Selection and Treatment of Mold Steels Used in the Plastics and Die Casting Industry" at Rochester. During the meeting Douglas Comstock and Robert Judd, University of Rochester Metallurgy students, were awarded scholarships by the Chapter. Shown are, from left: Mr. Schad; Mr. Comstock; Mr. Judd; and Morton Finch, the chairman of the Rochester Chapter

Speaker: George J. Schad
Carpenter Steel Co.

George J. Schad, sales metallurgist, Carpenter Steel Co., presented a talk on the "Selection and Treatment of Mold Steels Used in the Plastics and Die Casting Industry" at a meeting of **Rochester Chapter.**

Carburizing grade steels, toolsteels (0.40% C with 9 + 10% W and 0.40% C with 5% Cr) and stainless steels are the common types used. Mr. Schad remarked that many problems are solved by a hit and miss choice of materials and it is just lucky if it works.

There is no set formula for a selection of material. Ease of hobbing and machining is in many cases overbalanced by the end result. Hobbing is an art and all difficulties—both die making and molding—must be recognized. Extensive experience is the best attribute for acquiring good hobbing.

Mr. Schad stated that cold extrusion ideas could be used for cold hobbing. Parallels placed at the bottom allow excessive material to flow out of the bottom and a deeper hob can be obtained with less force.

Of prime importance in heat treating is good housekeeping. Cleanliness of the dies and close observance of the protective furnace atmosphere conditions are factors in the elimination of many troubles.

Polishing materials for dies should be cutters instead of buffers. High initial cost of diamonds is overcome by ease of polishing and speed of operation. Likewise, the harder the surface, the better the polish.

The working temperature of the dies must be considered in the choice of the mold steel because the actual heat plus frictional heat has never been actually calculated. Various steels can be hardened to the same hardness but at high heat the difference is remarkable (i.e., 0.40% C with 9 to 10% W at approximately 1100° is 260 Brinell, but 0.40% C with 5% Cr is only approximately 160 Brinell). The carbon-tungsten steel is susceptible to heat checking when die is water cooled and fatigue cracks develop. The carbon-chromium steel must be used if die is to be water cooled.

The selection of the mold material thus ends in a series of compromises. All steps from mold to end product are carefully weighed and the final product is awaited with crossed fingers.

The meeting was concluded with a question and answer session.—**Reported by Joseph V. Hurley for Rochester.**

Cermets and Sintered Metals Discussed at Peoria Meeting

Speaker: M. F. Judkins
Firth Sterling, Inc.

Malcolm F. Judkins, director, new products development, Firth Sterling, Inc., spoke on "Cermets and Sintered Metals" at a meeting held by **Peoria Chapter.**

Mr. Judkins opened with a brief history of the need for high-temperature materials occasioned by the advent of gas turbine engines, nuclear reactors, missiles, rockets, satellites, etc. He traced developments, past, present and future, in the effort to keep pace with the rapidly developing space age.

The practical temperature limits of known metals and alloys were indicated and their shortcomings were compared to the requirements for the re-entry of a vehicle into the earth's atmosphere. For instance, titanium is useful to about 1000° F., stainless steel alloys can be used to 1300° F., and the cobalt or tungsten-based superalloys retain their strength to approximately 1700° F. The highest known melting point of material is 7500° F. as compared to re-entry temperatures as high as 50,000° F.

A short digression into the basic principles of powder metallurgy served as an introduction of cermets, the only known materials which are usable above 1700° F.

Mr. Judkins stated that lack of structural strength is the greatest drawback to the large-scale use of these materials. Various solutions, such as spray forming and coatings of these materials, are being investigated in the hope of overcoming these shortcomings.

Mr. Judkins concluded with an optimistic appraisal of the future prospects of high-temperature materials. —**Reported by W. M. Hallett for Peoria.**

Salt Baths Topic at North Texas

"Developments in Salt Bath Heat Treatment" Were Discussed by John P. Clark, Jr., at a Meeting of North Texas Chapter. Shown are, from left: Earl Casey, program chairman; Albert S. Holbert, past chairman; Mr. Clark; Stephen Maszy, secretary; and C. E. Perkins, chapter chairman

Defines Fabricating Properties of High-Temperature Alloys

Speaker: Hiram Brown

Solar Aircraft Co.

Hiram Brown, technical adviser to the plant manager, Solar Aircraft Co., spoke at a joint meeting of the **Albuquerque Chapter** and the American Society of Mechanical Engineers on "Fabricating Properties of High-Temperature Alloys". Mr. Brown's presentation concerned fabricating difficulties not normally covered in literature.

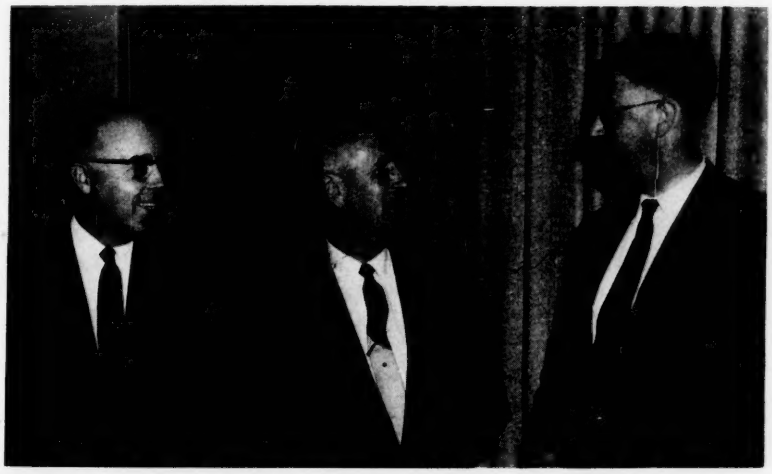
Areas in which Mr. Brown discussed solutions for these problems were mill defects, laboratory tests, coarse grain, grain boundary carbide networks, weldability, carbon pickup, zinc contamination, hot shortness, heat treating, descaling after heat treatment and stress corrosion. He elaborated on mill defects known as surface slivers or laminations which can cause splitting or cracking during forming or welding. In laboratory testing by the steel user to determine conformance to specification it is important that laboratory testing speeds agree with those used by the vendor. Coarse-grain material has lower ductility at all temperatures above 1100° F., making fine-grain austenitic steels desirable for fabrication or operation above that temperature, except that some very fine-grained steels will develop strain gradients during forming.

Mr. Brown defined grain boundary carbide networks as a condition that has been found to cause fabricating difficulties where severe forming or louvering is involved, and accelerated attack when exposed to certain corrosive conditions. This continuous carbide network can be produced during the rolling and processing of the material at the mill or by improper heat treatment. The formation of these grain-boundary carbide networks, or sensitization as it is also called, is not confined to 310 stainless but can also occur in the so-called "stabilized stainless steels" such as 321 and 347. If too high an annealing temperature is used the titanium or columbium become partially dissolved and then when the material is exposed to 1200° F. the chromium carbides form preferentially at the grain boundaries.

In the area of weldability of 347 and 321 the prime single factor is silicon content. A silicon content of below 0.50% caused poor weldability. Establishing a silicon range of 0.50 to 1.00% was the solution in this case. In the area of carbon pickups, Mr. Brown stated that many of the high-temperature alloys are hungry for carbon and will pick it up from many sources, an example being the marking on these alloys with regular lead pencils. Zinc contamination causes cracking in many stainless steels. It is the metallic zinc, not the zinc salt, that is the offender and it can come from zinc tags as one of many sources.

In the area of hot shortness, Mr. Brown explained that some of the high-temperature alloys have hot short ranges in which cracking can occur if stress is present at the same time. This was proved when cracks in parent metal at times ⅛ in. from the weld occurred only when stress was in effect at the time of welding. In heat treatment after welding annealing temperatures are critical and it is important to avoid slow cooling. The necessity for descaling after heat treatment depends on the application of the part. It is possible to supply an atmosphere to a furnace so that a very slight discoloration or a thin tight scale is obtained. This would be satisfactory for most applications, however for welding this slight amount of scale must be removed. Stress corrosion of austenitic alloys must not be ignored and occurs most frequently on equipment which operates intermittently at high temperature.—**Reported by G. J. Hof for Albuquerque.**

Warns of Hazards of Heat Treatment



Members of the Montreal Chapter Heard R. C. Stewart, Vanadium Alloys Ltd., Speak on the "Hazards of Heat Treatment". Shown are, from left: R. Thompson, Chapter chairman; Mr. Stewart; and P. M. Howard, councillor

Speaker: R. C. Stewart

Vanadium Alloys Ltd.

At a meeting of the **Montreal Chapter**, R. C. Stewart, chief metallurgist, Vanadium Alloys Ltd., spoke on the "Hazards of Heat Treatment". Mr. Stewart emphasized the importance of good design and showed a number of slides illustrating tool failures which could be associated with improper mass balance resulting in unequal expansion and contraction, inadequate fillets at changes in section and dissimilar steels being used for matching parts.

In describing the advantages of an interrupted quench over air and oil quenches as a precaution against cracking, Mr. Stewart pointed out that many a designer had fallen into the trap of not allowing for the fact that this method of heat treatment results in less density which must be compensated for by reducing the specified dimensions of the machined part.

On the subject of tempering the speaker recalled that he had encountered more failures as a result of tempering too soon than too late, as separate areas of expansion can be created by tempering a part whose core has not yet had time to harden. He also explained that tempering only part of a tool may cause failure as a result of stresses at the inner face between the tempered and untempered sections.

As a warning to troubleshooters it was suggested that much can be learned by visual examination before preparing samples for more detailed study. For example, vital evidence is often destroyed when samples are annealed in preparation for chemical analysis. The possible existence of decarburization should not be overlooked when investigating tool failures. Macro-etching will sometimes reveal segregation in the form of an ingot pattern but nowadays this cause of failure has been greatly reduced by using a small ingot in relation to the size of the finished part.

In addition to drawing upon a wealth of experience to illustrate the causes of failures and means of prevention, Mr. Stewart described the characteristics of the various grades of toolsteels and the types of salt baths used in their heat treatment. —**Reported by R. H. Peck for Montreal Chapter.**

Kansas City Executive Committee Aids Education

Members of the Kansas City Executive Committee Are, From Left, Front: H. P. DeWitt, Joseph Hershe, C. K. Kenyon, Fred Fitzgerald and W. Deterding. Second row, from left: M. O. Newby, E. H. Stahl, D. Goldberg and Jack Walker. Third row, from left: E. J. Blair, Harold Carter, Charles Minnich and Emmett Bagby

At a recent meeting of the Executive Committee of the **Kansas City Chapter** a motion was passed to support Wallace M. Good in his effort to advance the teaching of science to outstanding high-school students. Mr. Good, a science teacher at Wyandotte High School, Kansas City, Kan., is the originator of an outstanding program for promulgating science interest and the scientific method in young students. Mr. Good's plan is not the usual science fair type of thing—rather it requires promising students to perform fundamental and original research.

So far, the Student Affairs Committee has assisted Mr. Good and his students by furnishing him the necessary money required to make up his deficit for the 1957 program. At the Student Affairs Night meeting he was presented with a number of A.S.M. metallurgical texts, the A.S.M. Handbook and a subscription to *Metal Progress,* to help augment his personal library which is used heavily by his students. Since his library does not contain metallurgical reference material, this move may well inspire some students to choose metallurgy as a profession.

Aside from the above, plans are being formulated whereby the Student Committee will attempt to interest other local technical and scientific societies in Mr. Good's program. Because of the wide interest of area educators, it is felt that the spread of this program into other schools is very likely.—**Reported by E. J. Blair for Kansas City.**

Long Island Hears Talk On Materials and Missiles

Speaker: George Gerard
New York University

George Gerard, assistant director of research, New York University's College of Engineering, presented a lecture on "Materials and Missiles" at a meeting of the **Long Island Chapter.** In addition to serving on several technical panels of the National Academy of Sciences Materials Advisory Board, Dr. Gerard is also co-winner of the A.S.M.'s 1958 Henry Marion Howe Award.

Early measurements indicate that materials requirements for missiles and rockets are not as stringent as was anticipated by designers. Four factors of missile design were discussed at length with the aid of slides: air-frame design trends; structural materials; fabrication techniques; and structural analysis.

Referring to air-frame design trends, Dr. Gerard discussed the basic differences between the aerodynamic and ballistic missiles with respect to time in flight, temperatures attained and air-frame weight. Although ambient temperatures in leading edges and nose-cone sections are high, a large proportion of the total structural weight is at relatively low temperatures.

In discussing structural materials, Dr. Gerard used a three-dimensional plot of stress, temperature and time of actual missile components to illustrate the inadequacy of present stress rupture and creep testing techniques. He pointed out the advantages of using low-density materials in missiles. Basically these advantages are: lighter materials can be used in thicker gages, thereby providing larger heat sinks and reducing operating temperatures; and many missile components are subject to light buckling loads, and for this type of loading modulus of elasticity and density are more important factors than strength.

On the basis of these two factors, Dr. Gerard showed some slides illustrating the structural superiority of such low-density materials as beryllium and titanium.

However, when considering the third factor, fabrication techniques, materials such as beryllium and titanium present many difficulties, such as limited weldability and formability. It was then pointed out that the low ductility of light-weight materials presented some serious problems to the structural analyst. The most serious of these problems is the indeterminate stress concentrations caused by "accidental" notches. Dr. Gerard closed with the hope that a greater effort be made by the metallurgist and stress analyst to work as a team because the time has come where only the materials that satisfy the rigorous tests of both will do the job.—**Reported by R. Richards for Long Island.**

A.S.M. created the Annual Teaching Award in Metallurgy, open to teachers of metallurgy in the United States and Canada. Value $2000.

Presents Carnegie Lecture At Pittsburgh Meeting

Speaker: Morris Cohen

Massachusetts Institute of Technology

For the 11th Annual Andrew Carnegie Lecture, members of the **Pittsburgh Chapter** heard Morris Cohen, professor of metallurgy, Massachusetts Institute of Technology, give a report of recent work on the "Mechanism of the Hardening of Steel Through the Martensitic Transformation".

Before developing his topic for the evening, Dr. Cohen reviewed the highlights of Andrew Carnegie's life. He said that the steel industry was indeed fortunate to have had, as part of its heritage, a great man who rose above his humble beginnings and left lasting memorials to the arts, literature, science and humanity.

Dr. Cohen introduced his topic by saying that it would be a fresh look at an old problem—the hardening of steel. Slides of typical time-temperature - transformation diagrams of steels were presented to illustrate the temperature range of the austenite to martensite transformation. He defined hardening as the formation of martensite and hardenability as the avoidance of the upper transformation products of pearlite, bainite, ferrite and carbide. The hardness of martensite primarily depends on its carbon and nitrogen content, with the effect of alloying elements being secondary.

The technique Dr. Cohen used to explain why the martensitic reaction causes such a tremendous increase in the hardness of steel was to give four possible hypotheses and then evaluate each on the basis of current knowledge. The four suggested reasons were:

1. Strengthening of the bond between iron atoms (as in compound formation).
2. Work hardening due to the phase transformation (fragmentation of subgrains and microstrains on bent slip planes).
3. Solid solution hardening (lattice distortion due to atomic displacement around solute atoms).
4. Age hardening (i.e., locking of slip planes either by segregation —Cottrell atmospheres—or by precipitation — dispersion hardening—of solute atoms.

In summing up, Dr. Cohen said that the formation of martensite is one of nature's wonderful coincidences. We are privileged to have available great quantities of an element such as iron which is capable of an allotropic transformation so controllable with carbon that, by means of a diffusionless process involving unusual lattice shear mechanisms, tremendous increases in hardness are produced. Furthermore, the fact that the carbon and iron atoms are of such size that the bulging produced in the lattice is sufficient to cause the amazing amount of hardening is indeed remarkable. Through tempering, a control of the degree of solid solution and dispersion hardening is available for engineers to obtain a wide range of strength and ductility in hardened steel.—**Reported by D. W. Gunther for Pittsburgh.**

Forming for Uniformity Subject at New Orleans

Speaker: J. E. Harkins

Carpenter Steel Co.

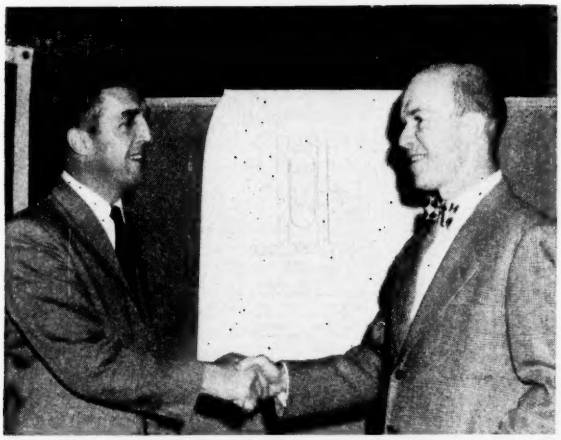
"Forming for Uniformity" was the subject of a talk given before the **New Orleans Chapter** by Joseph Harkins, territorial manager, Alloy Tube Division, Carpenter Steel Co. The talk, supplemented with a film, covered mill practices for welded tubing and pipe.

The methods used by Carpenter in producing stainless steel and high-alloy strip for fabrication of tubing and pipe at the Union, N. J., plant were shown and discussed.

Properties and applications of the welded tubing in stainless, Hastelloy and titanium were reviewed in a question period, and specific problems encountered by users were covered.

Of significance was the discussion concerning specification on seamless versus welded tube. The requirements on pressure testing of welded tube are above those of seamless tube, a fact skeptically received by many in industry, but substantiated by comparing ASTM specifications A 213-57-T and A 249-57-T.—**Reported by J. L. Shutek for New Orleans Chapter.**

Lectures at Savannah River



R. L. Menegus (Left), Is Shown Being Congratulated by Savannah River Chairman W. L. Worth Following the First Lecture in the Chapter's Educational Series on "Metallurgy of Nuclear Reactors". Mr. Menegus, reactor design engineer, DuPont Co., spoke on "Introduction to Nuclear Systems". Other lectures covered "Effect of Irradiation on Metals", "Effect of Corrosion on Selection of Materials", Metallurgy of Structural and Auxiliary Components", and "Metallurgy of Fuel Elements". (Reported by W. L. Worth)

Pittsburgh Boy Wins Award

The Buhl Planetarium in Pittsburgh Annually Sponsors a Science Fair for Junior and Senior High-School Students, and the Pittsburgh Chapter Awards Prizes to the Two Students With the Best Exhibits Related to Metallurgy. This year's winners were Robert McLaughlin (left), whose exhibit was entitled "A Study of Metal Whisker Growth", and Kurt Hepler, whose exhibit was entitled "Theory and Use of Bimetals"

Review Value Analysis at Hartford

R. G. Woodward and F. S. Sherwin, Raytheon Manufacturing Co., Spoke on "Cost Improvement Through Value Analysis" at a Meeting in Hartford. Shown are, from left: W. R. Johnson, executive committee member; Mr. Woodward; Frank M. Lister, technical chairman; and Mr. Sherwin

Speakers: R. Glenn Woodward and F. S. Sherwin

Raytheon Manufacturing Co.

R. Glenn Woodward, staff assistant, product cost control, and F. S. Sherwin, value analysis consultant, Government Equipment Division, Raytheon Manufacturing Co., presented an integrated talk on "Cost Improvement Through Value Analysis" at a meeting of **Hartford Chapter.**

Mr. Woodward pointed out that industrial competition has increased markedly on a world-wide basis, survival of American free enterprise is contingent on making a profit, and profit margins can be increased by reducing costs through value analysis.

Mr. Sherwin then traced the development of value analysis from the initial work of Larry Miles at General Electric to present-day methods of analysis.

With the aid of slides, both speakers presented basic ideas and examples of value analysis along with cost savings. It was stated that a typical analysis is performed in 3 hr. and follows the form: What is it? What does it do? What does it cost? What else would do the job? What will the latter cost?

The meeting was concluded with a question and answer period which emphasized to the audience the necessity for accurate cost data in value analysis.—**Reported by Ramon D. Burge for Hartford Chapter.**

Reviews Process Instrumentation

John McCauley, Application Engineer, Wheelco Instrument Div., Barber Coleman Co., Spoke on "Process Instrumentation" at a Meeting in Kansas City. He covered various applications of transducers with recorders and controllers in the metalworking field. Shown are, from left: G. Hummon, secretary; Mr. McCauley; and C. K. Kenyon, chapter chairman

Quality Requirements of Super-Duty Steels Noted

Speaker: B. M. Shields

U. S. Steel Corp.

Bruce M. Shields, chief metallurgist, Duquesne Works, U. S. Steel Corp., discussed "Quality Requirements of Super-Duty Steels" at a meeting of the **Southeast Ohio Chapter.**

Mr. Shields pointed out that the exacting requirements of steel used for aircraft, turbine and many other uses today do not permit the large safety factors which can be employed in the more common usages. For this reason, steel users are interested not only in the conventional chemical, tensile and hardness specifications but also insist upon determination of grain size, hardenability, internal soundness and cleanliness. A comprehensive quality control program is necessary to assure consistent production of high-quality steels. This program involves numerous statistical studies which are aided by the use of advanced computing equipment.

The quality requirements for the manufacture of two of the super-duty steels for aircraft and missiles, AISI 4340 and 410 stainless, were discussed in detail. Magnaflux tests are employed to determine the suitability of the steels for the application. Standards based upon a statistical study of the magnaflux results have been adopted for controlling the steel heats. Inspection of the raw materials used in making these steels is essential; they must be low in such minor constituents as copper, tin and lead.

Maximum cleanliness results if the oxygen-blowing period is controlled within close limits. Either too long or too short a blow gives decreased cleanliness. In this connection it is essential to prepare a proper charge to obtain the optimum working period. The effect of the carbon content prior to slag-off on cleanliness was illustrated. In the case of AISI 4340, the carbon content must be maintained above 0.25%. while in the case of 410 stainless, the carbon should not be blown below 0.08%.

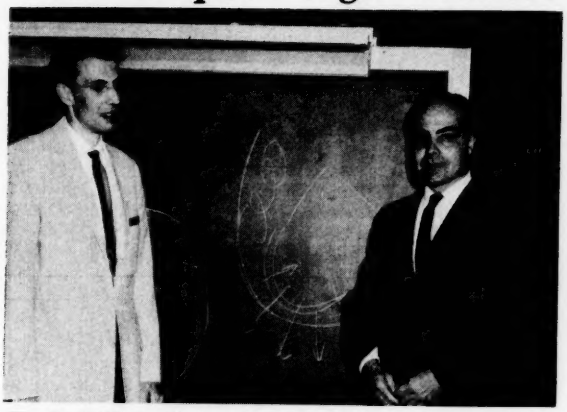
The tapping temperature must be closely controlled, preferably within ± 150 of the aim in the case of AISI 4340 steel. It is also essential to maintain the proper temperature gradient during the course of the heat.

It is preferable to add ferroalloys early in the course of the heat and to keep final additions at a minimum. The trend has been toward using cleaner ferroalloys when possible in manufacturing super-duty steels.

Proper deoxidation practice is also essential. Calcium silicon is added in the ladle to convert the few remaining nonmetallic inclusions to a less objectionable form.

Proper size and shape of the ingots help to maintain high quality. Ingots should have a height to cross section ratio of 2.5 or less to meet magnaflux specifications.—**Reported by H. W. Rathmann for Southeast Ohio.**

Talks on Space Flight Vehicles



W. S. Pellini, Right, Who Spoke on "Application of Materials for Space Flight Vehicles" at a Meeting in Oak Ridge, Is Shown With Chairman W. S. Dritt

Speaker: W. S. Pellini

Naval Research Laboratory

More than 300 high-school science students and teachers from the East Tennessee area attended the annual Student Metallurgy Night meeting held by the **Oak Ridge Chapter.** William S. Pellini, superintendent of the metallurgy division, Naval Research Laboratory, presented a talk on "Application of Materials for Space Flight Vehicles".

Mr. Pellini described the variety of problems faced by the metallurgist in the application of materials to high-speed flight, re-entry, and space flight vehicles.

High-speed sustained flight is involved with the establishment of steady-state temperature conditions known as radiative equilibrium temperatures. The temperatures attained by the skin of the aircraft depend not only on the temperature of the hot boundary layer gases but also on the emissivity characteristics of the skin. If emissivities in the order of 0.8 or 0.9 (black body=1.0) are attained, molybdenum alloys will serve for skin material even for the hypersonic speeds required for the development of adequate lift at altitudes in excess of 200,000 ft.

Insulation and cooling systems are required to prevent overheating of the interior of the aircraft. The problem of leading edges (stagnation points) are more severe; at high speeds it is necessary to use conduction cooling or liquid metal cooling. In both cases the approach involves transferring the heat back to cooler positions which then serve as radiators.

Re-entry heat problems, as typified by nose cones, involve extreme temperatures beyond the limits of known materials, if radiative equilibrium is established. The short time, pulse heat flux conditions associated with re-entry provide for solutions based on absorbing the heat by diffusion to a heavy wall heat sink. The important property is therefore a high heat diffusivity which implies high thermal conductivity and high specific heat capacity. For extreme flux conditions, ablation (melting) systems are required. In this case, organic materials have been shown to be superior to metals. Space flight systems such as satellites are involved with heating due to radiation from the sun. Two general types of thermal protection systems may be used: (1) skins having high infrared reflectivity, and (2) skins having high emissivity. Since high emissivity implies high absorptivity it is necessary to spin the satellite so that the heated surface is constantly rotated away from the sun to the earth for purposes of emission cooling.

The high flame temperatures (4500 to 7000° F.) of both solid and liquid rocket motors require special cooling devices for the nozzles. Liquid systems generally use regenerative cooling involving the passage of the propellant liquids through the double wall of the chamber prior to entering the combustor. In other words, the fluid cools the hot wall before it is burned. Solid propellant nozzles are cooled by the use of heat sink principles; for example, graphite, molybdenum or tungsten nozzle inserts backed by heavy steel walls. The heat sink requirements are dictated by the burning time. Mr. Pellini emphasized that specific thermal protection systems must be designed for specific conditions of heat flux and time. Thermal protection systems do not represent a "crutch" to be used in absence of materials which can withstand the temperatures involved. The materials field should recognize that thermal protection systems represent sophisticated use of materials in combination to obtain a "least weight" solution to thermal problems.

Following Mr. Pellini's talk, a technicolor movie entitled "How Metals Behave" was shown. The film, prepared for A.S.M. by Massachusetts Institute of Technology, shows the part the metallurgist plays in modifying and adapting metals to practical use.

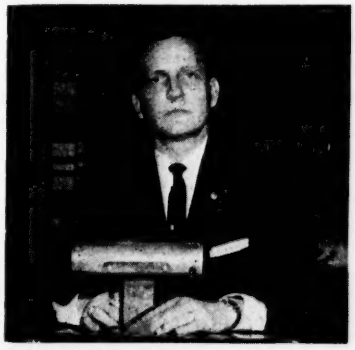
Joe Earl Spruiell of Knoxville was presented a $400 A.S.M. scholarship after the talk. This was followed by an announcement that the Oak Ridge Chapter was establishing a $250 scholarship for a sophomore metallurgy student at the University of Tennessee.

Exhibits of metal structures and fabricated parts used in nuclear reactors were shown after completion of the formal part of the program.—**Reported by P. L. Rittenhouse for Oak Ridge.**

Pres. Lorig at Springfield

National President C. H. Lorig, Technical Director, Battelle Memorial Institute, Spoke on "Selection of Materials in This Changing World" at a Meeting of Springfield Chapter. He is shown, left, with Roger R. Heroux, chairman. (Reported by S. Spungin)

Automation Controls



Henry Boppel, Sheffield Corp., Spoke on "Gage Application to Automation Controls and Assembly Machines" at a Meeting of Puget Sound Chapter. He described his company's precision instruments and their use in the manufacture of diesel engines, motorcycles, aircraft, automobiles and truck motors

Presents Story of Investment Casting

Speaker: Charles W. Schwartz

Misco Precision Casting Co.

"Present Status of the Art of Investment Casting" was the subject of a talk given by Charles W. Schwartz, technical director, Misco Precision Casting Co., at a meeting of the **Richmond Chapter.**

Mr. Schwartz gave a brief history of the investment or "lost wax" casting process, pointing out the great progress that has been made in the last 18 to 20 years.

Both wax and plastic are now used for making patterns with plastic being preferred when extremely close dimensional tolerances are required or when the patterns may be subjected to rough handling or long storage conditions. The economy of using plastic versus wax for pattern material is related to the volume of the production runs. Plastic tooling is much more costly than the soft metal dies used for wax injection and accordingly can only be justified for high volume production runs.

After the patterns are produced by pressure injection of the pattern material into soft metal dies, they are assembled into clusters, the number of patterns in a cluster depending on their size. Assembly in jigs and fixtures insures correct spacing during the attachment of runners, gates and stiffeners or crossbars. Clusters are then inspected and are ready for one of two mold-production methods used prior to casting.

The conventional investment method consists of dipping the cluster in a thin slurry of silica-type refractory, thoroughly stuccoed with a coarse silica sand to provide good keying of the backing or secondary investment, and allowed to air dry for several hours. When dry, the cluster is placed, sprue down, on a steel plate, and a high-temperature alloy flask is placed around it. The semi-solid investment—a mixture of fireclay, silica sand, silica flour and ethyl silicate—is placed in the flask, and the flask is set on a slow-moving vibrating conveyor, which causes the investment to pack thoroughly around the cluster. The ethyl silicate gel solidifies and the mold goes to the dewaxing and preheating oven, which has a temperature range of 1600 to 1900° F. The mold is removed from the oven, clamped over the opening of the melting furnace and filled with molten metal by inverting the furnace. After cooling to room temperature, the cluster is removed from the mold on a vibratory shakeout. A second vibratory shakeout removes most of the remaining mold material. The cluster goes through an abrasive blast unit for removal of mold material and is further cleaned by treatment in molten caustic soda which chemically dissolves any remaining mold material. The cluster is cut apart and each part receives final finishing and inspection.

Misco has developed a new process, known as the Mono-Shell Process, in which a ceramic shell mold is used instead of the conventional mold described above. The process consists of dipping the wax or plastic cluster into a refractory slurry and allowing it to dry for a short period. It is redipped and dried several times, until a ceramic shell about ¼ in. thick is built up. This forms a monolithic shell that is strong enough to be used without being covered by a secondary investment material in a flask. Melting and burning out the plastic pattern material is much more rapid. The shell is rapidly lowered into a 1900° F. dewaxing furnace which causes the complete burnout of the wax material. It is then cooled to room temperature in which condition it can be used immediately or stored indefinitely. The thermal stability of this shell permits wide variation in the preheat temperatures that can be used. Metal can be poured into these molds at temperatures ranging from room temperature to 1900° F. and the fast rate of cooling has been found to be beneficial to most metal structures. The shell is strong enough to permit direct clamping onto the melting furnace so that metal can be poured into the cavity on rollover as is done by the conventional investment method. As the metal cools after solidification, stresses are set up which cause most of the shell material to spall away from the casting. The remaining ceramic is removed by vibratory shakeout and sandblast.

Mr. Schwartz said the Mono-Shell Process improves the surface quality of castings because the refractory properties of the mold material used permit higher metal pouring temperatures, and the molds are cleaner, resulting in fewer scrap castings. On small Mono-Shell investment castings, tolerances can be held to ±0.005 in. per in. On larger castings, they can be held to 0.030 to 0.040 in. in 15 in. Misco plans to make investment castings up to 5 ft. long and weighing up to 300 lb. by using sectional Mono-Shell molds bonded together.

Another recent development of importance to this industry is in the field of vacuum investment casting. Misco has developed a vacuum furnace which enables them to charge molds and metal through a system of interlocks into the melting chamber. Castings produced by this technique are of improved quality with respect to surface conditions, X-ray and Zyglo inspection, and metallurgical properties of the alloys being used. Many of the newly developed high-temperature alloys such as nickel and cobalt-based materials containing aluminum and titanium have been successfully processed by Misco. They report significant improvements in stress rupture life, oxidation resistance and ductility when processed by the vacuum melting technique.—**Reported by H. D. Moorman for Richmond.**

Aluminum in the Electrical Industry

Shown at a Meeting of Eastern New York Are, From Left: John H. Westbrook, Chairman; S. R. Chapman, Aluminum Co. of America, Who Spoke on "Aluminum in the Electrical Industry"; and C. Waters, Technical Chairman

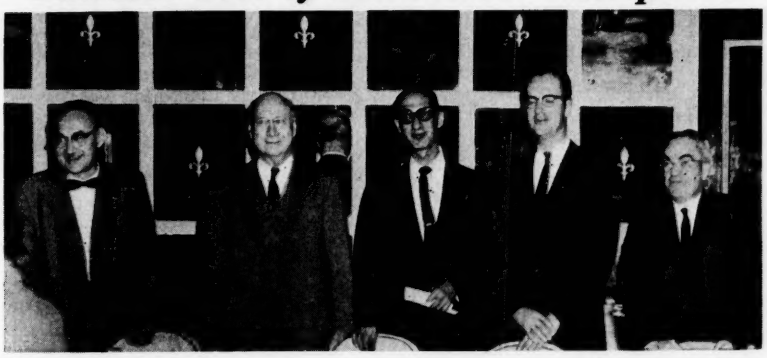
Speaker: S. R. Chapman

Aluminum Co. of America

At a recent meeting of the **Eastern New York Chapter,** S. R. Chapman, Aluminum Co. of America, spoke on the use of "Aluminum in the Electrical Industry". He also showed a new and unusually interesting film on the extraction of aluminum.

Mr. Chapman noted that 20% of the annual production of aluminum goes into the electrical industry. He commented on the virtues of aluminum, such as its lightness, resistance to corrosion, electrical and thermal conductivity, nonsparking, appearance, reflectivity, formability and weldability. He recommended the use of joint compounds in the bolting of electrical connections. Alcoa is currently working on the welding of aluminum to aluminized steel to connect aluminum to steel. In addition to aluminum's use in bus bars and wire, it is employed in printed circuits and as a structural material for packaging electronic systems.—**Reported by Louis Ianniello for Eastern New York.**

Outlines Uses of Controlled Atmosphere



"Practical Application of Controlled Furnace Atmosphere" Was the Topic Discussed by C. A. Mueller, Lindberg Engineering Co., at a Meeting in New Jersey. Shown from left: Henry Skarbek, secretary; H. D. McKinney, past chairman; David B. Mazer, technical chairman of the meeting; Mr. Mueller; and John L. Everhart, chairman. (Photograph by P. A. Giordano)

Speaker: Charles A. Mueller
Lindberg Engineering Co.

Charles A. Mueller, Lindberg Engineering Co., spoke on "Practical Application of Controlled Furnace Atmosphere" at a meeting of **New Jersey Chapter.** Mr. Mueller outlined the basic principle of controlled atmospheres and the primary reasons for using controlled atmospheres; namely, minimizing scale and prevention of decarburization. He also discussed utilization of atmospheres to perform various operations such as bright hardening of stainless steel, nitriding and carburizing.

The carbon content of the steel and the temperature required for heat treating dictate the dew point required to maintain equilibrium. Generally speaking, the higher the carbon content and temperature, the lower the dew point required for good atmospheric control.

The operating characteristics of different types of atmosphere generators were discussed. These included the older type charcoal generator, the exothermic generator, and the more common, currently used endothermic generator. It was explained that, in most cases, a high hydrogen atmosphere produced from dissociated ammonia can be used in place of cylinder hydrogen. A good example of the use of dissociated ammonia was given as the sodium hydride descaling bath which utilizes sodium pig and dissociated ammonia to produce sodium hydride. An interesting aspect of controlled atmospheres and one of current interest was the high-temperature carburizing process in the 1700-1850° F. range where increased case depths are achieved in far shorter time than in the past.

In the selection of furnaces for controlled atmosphere work, there are certain important features which should be considered, such as the capacity of the generator, furnace shell construction, choice of lining material and auxiliary handling equipment. Many types of controlled atmosphere furnaces were illustrated and their advantages and uses discussed. Among those shown were the "L" type, the conveyor type, the roller hearth and the rotary retort.

A question and answer period followed with many interesting points being raised by the audience as to particular problems connected with controlled atmosphere furnace operations.—**Reported by J. B. Bursley for New Jersey.**

Plastic Deformation Of Metals Discussed At Meeting in Ontario

Speaker: G. B. Craig
University of Toronto

"Plastic Deformation of Metals", with particular reference to critical resolved shear stress, was the subject presented by G. B. Craig, department of metallurgy, University of Toronto, at a meeting of the **Ontario Chapter.**

The most common form of test that subjects metal to plastic deformation is the conventional tensile test from which we can evaluate such properties as tensile and yield strength, elongation, reduction of area, etc. In general, the body centered cubic metals containing impurities will show a definite yield by a "drop in the beam" phenomenon, while face-centered cubic materials fail to show this definite yield point in their stress-strain curve.

All metals possess a definite critical resolved shear stress. There are many factors, however, that influence the magnitude of this stress, in particular:

Temperature of Test: As temperature increases, the strength of a given metal will decrease due to attendant increase in atomic mobility.

Rate of Strain: Metal strength increases proportionately with the rate of strain. This is obviously influenced by the relative rates of work hardening and recovery. As temperature increases, the effect of recovery has greater prominence and the rate of strain also has a greater effect on yield strength.

Surface Condition: As surface dislocations in a metal are not as tightly held as those in the interior of a crystal, addition of an adhering film to the surface of a metal can increase the critical shear stress by factors of two or even three times. This has been demonstrated by plating of zinc on copper. The surface dislocations become locked, and thus can double the normal stress required to cause a definite measure of strain.

Specimen Size: Small test specimens may exhibit satisfactory ductility whereas the corresponding large machine part (e.g., a turbine rotor) may fail in a brittle manner.

Prior Deformation: This factor will cause an increase in critical shear stress, primarily due to influence of work hardening. A recovery process can oppose this condition by causing the metal to return to its initial strength.

A true "drop in the beam" yield point has recently been produced even in the face centered cubic metals aluminum and nickel by prior cold working.

Developing a low-angle tilt in the crystal lattice of metals by specific amounts of prior deformation can cause increased strength. This may be considerably enhanced by a subsequent tempering treatment.

Purity of Metal: Presence of impurities will increase the strength of any given metal. This, of course, is the principle of alloying. Soluble atoms will contribute to a greater increase in strength than those that are particle or compound-forming in nature.

Grain Size: Finer grain sizes will, in general, contribute to higher strength values. This may be accounted for on the basis that dislocations attending strain will tend to pile up at grain boundaries. Thus, as the grain boundary area is increased (e.g., fine grain), the strength also increases.

It was pointed out that yield strength describes the magnitude of stress required to move dislocations, not to generate them. In a body-centered cubic material, such as iron, a dislocation can appear as a longitudinal imperfection (troughs) where elements such as carbon and nitrogen can segregate. It is this condition that accounts for the "drop in the beam" during tensile testing. These linear dislocations are not stable in face-centered cubic metal. Thus, the stress barrier in a segregated trough will be less, causing the strength to increase continuously with strain.—**Reported by B. M. Hamilton for Ontario Chapter.**

Talks at Chicago-Western On Welding Metallurgy

Speaker: W. D. Doty

U. S. Steel Corp.

W. D. Doty, division chief, Applied Research Laboratory, U. S. Steel Corp., discussed "Welding Metallurgy" at a meeting of the **Chicago-Western Chapter.**

Mr. Doty described the major welding processes, the important metallurgical parameters in welding and tests and methods of evaluating the quality of welds. The talk was concluded with a description of a recently developed high yield strength weldable alloy steel.

Shielded metal arc and submerged arc welding were clearly described and illustrated. In the former, a coated electrode is used, whereas, in the latter, an uncoated electrode is employed because protection from the atmosphere is afforded by the fusible granular flux which "submerges" the area being welded. Submerged arc welding is further characterized by high current densities and heat input, large pool of molten metal and slower cooling rates. The powerful effect of plate thickness on cooling rate of a weld was emphasized by means of slides. Thus for any one energy input cooling rates increase with thicker base plate. Cooling rates at 1000° F. were used for comparison purposes because of the transformation occurring at or about that temperature in many steels.

Information on cooling rates is extremely important because, coupled with continuous cooling T-T-T diagrams, they make it possible to predict the weld zone microstructure. Since the performance of a weld may be controlled by the heat affected zone it is imperative that the cooling rates be such that the resulting microstructures have desirable mechanical properties. Thus, for example, in steels in which low carbon martensite may be obtained it is desirable to have a rapid cool to precipitate such low-carbon martensite. On the other hand, in the case of high-carbon steels it is desirable to eliminate high-carbon martensite. The latter, when precipitated from H_2 enriched austenite, gives rise to underbead cracking. The transformation strains coupled with the H_2 cause the cracking. The use of low H_2 electrodes minimizes this problem.

Several tests designed to measure the quality of welds were described. The underbead cracking susceptibility test employed at the U. S. Steel Laboratory and the longitudinal beadweld notch bend test were illustrated and discussed. In the latter a transition curve is obtained as the angle of bend and the fracture appearance are plotted versus temperature. It has been observed that in the case of 0.25% carbon steel the weld may have a durability-transition temperature equivalent to that of the base metal provided preheat or postheat treatments are carried out. Slow welding has the same effect.

Attainment of strength in a weld is not usually a problem; however, the attainment of sufficient ductility to permit further forming and the attainment of sufficient notch toughness are problems of much greater magnitude.

Dr. Doty described the development and properties of the new steel designated as T-1 which was developed with the intention of taking advantage of the rapid cooling associated with welding. Thus preheat and postheat treatments are usually unnecessary. Compositionally the steel is characterized by low carbon to enhance weldability and yet because of the alloy content it has sufficient hardenability so that when it is welded it has a structure consisting of low-carbon martensite and bainite. Both structures are characterized by good notch toughness. Desirable welding conditions, both from the standpoint of heat input and preheat, were clearly illustrated.

Dr. Doty concluded by saying that more steels designed to take advantage of the welding heating and cooling cycles are being developed. He further stated that the results of weldability tests are relative and must be considered as such until such time as correlation with field behavior is fully obtained.—**Reported by D. J. Garibotti for Chicago-Western.**

Reveals Scope of Mineral Deposits Present in the Sea

Speaker: Henry Menard

Scripps Institute of Oceanography

Seventy-five members and guests of the **San Diego Chapter** heard Henry Menard from the Scripps Institute of Oceanography speak on "Untapped Mineral Treasures of the Sea".

Dr. Menard led the first contingent in Scripps' recent "Downwind Expedition" conducted under the auspices of the International Geophysical Year.

He revealed the existence of vast metal formations located on the floor of the oceans. Manganese concentrations, in particular, are found in low sediment areas and have been accumulating at a rate of 1/30 in. per 10,000 years from minerals in the sea water. Some of the larger nodules discovered reach a size of 1 ft. in diameter and 2 ft. long and may cover 25 to 50% of a given area.

Recovery operations are presently very inefficient because the treasures are located in known depths of ½ to 3 miles. New engineering concepts will be required to commercially mine these submarine lodes.

In the "Downwind Expedition" a special camera was used to locate promising deposits. Samples were brought to the surface by a chain bag dredge at the end of a ½ in. steel cable. Two to three hours are often consumed to make a single dredge haul by power winch.

At today's industrial rate of consumption, Dr. Menard estimated there is enough manganese waiting to be mined in the ocean to last 100,000 years.

Substantial quantities of other minerals continually being concentrated by these little known ocean processes include copper, nickel and cobalt.

Dr. Menard reported that Russia may also be making an investigation in this field of mining the sea floor. According to present day International Law, these mineral treasures are "free for the taking" outside of continental boundaries of all countries.—**Reported by Richard Messar for San Diego.**

Describes Liquid Metal Fuel Reactor at San Diego

Speaker: David Gurinsky

Brookhaven National Laboratory

Over 250 members and guests of the **San Diego Chapter** attended a dinner meeting at General Atomic's ultra-modern cafeteria facilities, and over 300 persons heard David Gurinsky, Brookhaven National Laboratory, speak on "Liquid Metal Fuel Reactors". Dr. Gurinsky is currently associated with the General Atomic Division of General Dynamics, Inc., during a year's sabbatical.

David Gurinsky

Dr. Gurinsky discussed materials problems involving chemical and metallurgical corrosion. Various base metals have been studied for possible use with molten bismuth-uranium homogeneous reactors. Useful and sometimes inexplicable effects of minor elements have been discovered which reduce corrosion, diffusion and mass transfer effects. These important scientific advances were cited by the speaker to illustrate the feasibility of the liquid metal fuel reactor.

Following the technical meeting, a tour of inspection was made of General Atomic's development and fabrication building. — **Reported by George Cramer for San Diego.**

Report on the Educational Activities Sponsored by the Golden Gate Chapter

The **Golden Gate Chapter's** Educational Program has been prepared with the purpose of providing a wide range of subjects of interest to nonmetallurgists, metallurgists and specialists in several fields of current interest.

To this end, six separate phases of the metallurgy program are to be presented throughout the 1958-59 season.

Elementary Metallurgy Courses

George Thurston,
Subcommittee Chairman

This program, which began early in September, consists of five courses given at the University of California Extension Centers in the San Francisco area and sponsored by the Golden Gate Chapter. They are:

1. Metallography Laboratory.
2. Modern Welding Technology.
3. Metallurgical Service Analysis.
4. Basic Metallurgy.
5. Applied Ferrous Metallurgy.

Each course consists of 15 meetings presented by competent metallurgists. They are designed for those interested in upgrading their knowledge of industrial metallurgy.

Metallurgical Seminars

Ted Swanson,
Subcommittee Chairman

These seminars are designed to provide opportunities for discussion on an advanced level of various specialized metallurgical fields. Seminar leaders guide the discussions.

The most recent seminar series was concluded in January. Subjects for discussion included: Brittle Fracture; Ductile Ceramics; High-Temperature Metals; Explosive Forming of Metals; and Cathodic Protection of Metals.

The seminars are given jointly by the Golden Gate and Santa Clara Chapters and are held at the University of California in Berkeley and at Stanford University, Palo Alto.

Metals Engineering Institute Courses

B. Berlein, Subcommittee Chairman

The M.E.I. course is an innovation in the Educational Program of this Chapter. The subject for the courses was selected by a poll taken by Bay Area metals people and is: "Heat Treatment of Steel".

The enrollment fee of $50 is a reduction—endorsed by A.S.M. Headquarters in Cleveland—from the $80 fee charged on a correspondence-course basis.

Two separate groups participate in the courses. One group consists of 24 employees of Earl M. Jorgensen Co., Oakland, with R. Nichols as instructor. The other group consists of enrollees from all over the Bay Area. This course is held on alternate Thursdays at the Shattuck Hotel in Berkeley and the California Hotel in San Francisco. The first class was on Nov. 13 at the Shattuck Hotel and the course will conclude on Mar. 5.

This course uses 15 Metals Engineering Institute lesson-texts, and is instructed by Glenn Lattin, chief metallurgist, Dalmo-Victor Co. An M.E.I. diploma is awarded upon satisfactory completion of the course. It is presented by the Golden Gate Chapter to provide advanced metallurgical studies for those who have completed elementary metallurgy courses and for others interested in the metallurgy of heat treating.

Nondestructive Testing Course

Sam Wenk and Clayton Ward,
Subcommittee Co-Chairmen

Beginning in February, a comprehensive course in many phases of nondestructive testing is to be presented in Berkeley. Nine lectures will be given by experts from various parts of the West on the following subjects:

1. Economics of Nondestructive Testing
2. Fundamentals of Radiography
3. Production Radiography
4. Isotope Radiography
5. Magnetic Particle Inspection
6. Penetrant Inspection
7. Contact Ultrasonics
8. Immersion Ultrasonics
9. Practical Eddy Current Testing

The enrollment fee is $5 for members, $10 for nonmembers.

Spring Lecture Series

A. Neiman, Subcommittee Chairman

This phase of the Educational Program begins in April 1959. The subject for the series is "Fabrication of Space-Age Materials", a highly appropriate subject for a West Coast setting because of the aircraft, missile and atomic energy activities in the region which require increased use of newer metals in their fabricated structures.

Fabricating shops must learn the characteristics of "space age" metals and the effects of forming, joining and heat treating of these materials—to meet the demand for satisfactorily fabricated structures.

This course has been planned to answer many of the questions and solve the problems involved in fabricating "space age" materials.

Lectures will be presented by technical experts from research and industry in accordance with the following schedule:

Apr. 8—Criteria For Selection and Fabrication of "Space Age" Materials
Apr. 15—Nickel and Cobalt - Base High-Temperature Alloys
Apr. 22—New High-Strength Titanium Alloys
Apr. 29—Characteristics of Refractory Metals (W, Ta, Mo, Cb)
May 6—Fabricating Characteristics of Ultra High Strength Steels

There will be no charge for this series, which will be held in the San Francisco Area.

Monterey Seminar

F. L. Coonan,
Subcommittee Chairman

This seminar, a one-day technical session at the U. S. Naval Post Graduate School, Monterey, Calif., is sponsored by the Golden Gate Chapter in May each year. The subjects to be discussed in the 1959 seminar have not yet been definitely decided.

Second Western Heat Treating, Brazing and Welding Conference

N. McLeod, Subcommittee Chairman

This two-day conference proved very successful, especially from a technical standpoint, in 1958, and will be repeated in 1960 as a three-day meeting. The committee has begun work on obtaining information necessary to decide on date of presentation, location, publicity and selection of authors of technical papers. The conference will be conducted in close cooperation with the A.S.M. National Headquarters, and is to be presented for metallurgical and welding people from the eleven Western States.

* * *

The Educational Program is one of the Golden Gate Chapter's prime objectives. As such, it is allotted the largest budget of any phase of Chapter work. Technical people in the San Francisco area are consulted in order to shape this effort as closely as possible to conform with the areas of greatest current industry interest.

The changing nature of this overall effort each year reflects the advancing metallurgical trends in this fast-growing section of the country, and reveals the increasingly important role which must be played by A.S.M. to fulfill its responsibilities to its members and to the industrial community.—**Reported by R. C. Bertossa, Chairman, Educational Committee for the Golden Gate Chapter.**

M.E.I.'s 1000th Student

Louis E. Klemm, National Screw and Manufacturing Co., Is the 1000th Student Enrolled in the Metals Engineering Institute of the American Society for Metals

Louis E. Klemm, 41, laboratory supervisor of the National Screw and Manufacturing Co., Cleveland, Ohio, has the distinction of being the 1000th student enrolled in the Metals Engineering Institute of the American Society for Metals. He enrolled late last October.

The Metals Engineering Institute is a home study and in-plant training program designed to help metalworking personnel keep abreast of the advances in metal science and up-grade their own capacities for the jobs at hand. The Institute is not quite a year and a half old.

Mr. Klemm is currently taking the course in "Electroplating and Metal Finishing". He is a two-time student, having successfully completed a first course in "Heat Treatment of Steel".

In commenting on his work, Louis states that the M.E.I. "has been valuable because of its clear presentation of the theory" of the many practical applications he daily meets. "This is especially true in the research field", he says. He further feels that he is "getting a better picture of the whys and wherefores of the science of heat treating".

Mr. Klemm, a resident of Willowick, Ohio, is married and has three children. His education was obtained in Youngstown, Ohio, where he graduated from Rand High School. Since then he has taken night courses at Youngstown University and Case Institute of Technology.

As an indication of the tremendous dissemination of engineering information, a compilation shows that in one year the A.S.M. collected, edited, published and distributed over *one hundred million pages* of metallurgical information.

Receives Eisenman Medal

Philadelphia Chapter Chairman Charles Turner Is Shown Presenting the William Hunt Eisenman Medal to Clarence H. Lorig, National President A.S.M.

Receives Eisenman Medal

C. H. Lorig, A.S.M. President, was the recipient of the second William Hunt Eisenman Medal at the "Bill Eisenman Night" held by the **Philadelphia Chapter.** The first medal was sent to Mrs. Eisenman.

The Eisenman Medal was established by the Philadelphia Chapter

to honor the former secretary of A.S.M., and the Chapter plans to honor each "Bill Eisenman Night" speaker with a similar medal.

Charles Turner, Chairman, before presenting the Eisenman Medal to Dr. Lorig, read the following citation:

"William Hunt Eisenman Medal Citation to C. H. Lorig on Nov. 28, 1958. In recognition of your outstanding dedication and service to A.S.M., development of aims of the Society, and in recognition of your leadership in guiding and stimulating important research in the field of refractory metals and alloys for the advancement of the metals industry, the Philadelphia Chapter A.S.M. is proud to present you with the William Hunt Eisenman Medal".

Dr. Lorig spoke on the "Selection of Materials in this Changing World". He stressed the importance of the proper selection of materials to meet extreme environmental conditions not known in the field of metallurgy just a few years ago.—**Reported by N. J. Petrella for Philadelphia Chapter.**

Baltimore Hears Talk by Two Western Electric Engineers

Speakers: S. R. Whipple and M. Dinsmore, Jr.

Western Electric Co.

At a meeting of the **Baltimore Chapter,** Stanley R. Whipple, chief product engineer, and M. Dinsmore, Jr., engineer, Point Breeze Works, Western Electric Co., were guest speakers.

Mr. Whipple talked on "Tools of Telephony" and described the various operations of both the local Western Electric plant and affiliated companies of the Bell System. Point Breeze Works produces all the toll cable, coaxial and some exchange cable used by the Bell System. Cable and wire manufacturing operations were described in detail and a movie entitled "Tools of Telephony" which illustrated Mr. Whipple's talk was shown.

Mr. Dinsmore described the "Polyethylene Handling System" which is employed in the final coating operation of the cable and wire. Mr. Dinsmore is the designer of this system which employs 10,000-lb. capacity plastic bags to ship, transfer, store and feed the polyethylene into the coating operation. Special railroad cars have been designed to handle these unique bags which have replaced 50-lb. paper bags. Mr. Dinsmore's system has resulted in a substantial saving in time and money to the company and a considerable reduction in spoilage. The plastic bags can be stored in the open without danger of the polyethylene being affected by the weather.—**Reported by John A. McKay for Baltimore.**

Metallurgical News and Developments

A Department of *Metals Review*, published by the American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio

Devoted to News in the Metals Field of Special Interest to Students and Others

Foundry Conference — Penn State's Second Biennial Foundry Conference will be held June 25 to 27, 1959, at University Park. Inquiries should be addressed to: The Pennsylvania State University, University Park, Pa.

Powder Metallurgy—"Metal Powder Report" will include a special supplement to forthcoming issues, listing definitions of important terms used in metallurgy in principal European, Asian and African languages. Write to Powder Metallurgy Ltd., Berk House, Portman Sq., London W.1, England.

Materials Engineering—Proceedings are now available for two courses conducted last summer at Penn State University dealing with Materials Engineering Design for High Temperatures and Mechanical Properties of Materials. Write to J. Marin, Dept. of Engineering Mechanics, The Pennsylvania State University, University Park, Pa.

Aircraft Castings Association — A group of leading steel foundries have formed a nonprofit corporation to increase the use of ferrous castings for aircraft, missile and related industries. Address inquiries to: W. W. Stevens, Jr., Stanley Foundries Inc., 6009 Santa Fe Ave., Huntington Park, Calif.

Welding News—An information center supplying information about welding and related fields has been established by the American Welding Society at its headquarters, 33 W. 39th St., New York 18, N. Y.

Rhenium—Chase Brass & Copper Co. has announced commercial production of wrought rhenium rod, wire and strip for the first time in this country.

Coating Process—A protective coating for molybdenum to shield the metal against oxidation at high temperatures has been devised by National Bureau of Standards researchers for the Navy Bureau of Aeronautics.

Foil Welding—An European process making smooth, high-strength, dense welds of non-overlapping type at unprecedented speed has been introduced to the United States and Canada by Precision Welder and Flexopress Corp.

Stainless Steel—Stainless steel that is buoyant in water has been developed by the Crosley Division of Avco Manufacturing Corp.

Doehler Award—The Annual Doehler Award for outstanding contributions to the advancement of the die casting industry and process will be awarded in September. Nominations for the award and supporting papers or material will be received until Apr. 15, 1959. Address entries to: Award Committee, American Die Casting Institute, 366 Madison Ave., New York 17, N. Y.

Cadmium Coating—A new, low-cost method for vacuum deposition of cadmium to protect high tensile steels against corrosion without danger of hydrogen embrittlement has been developed jointly by NRC Equipment Corp. and National Research Corp. This process is expected to find immediate application in the aircraft industry for use on parts made of high heat treat steels. For further information write to: NRC Equipment Corp., 160 Charlemont St., Newton, Mass.

National Meeting—The National Program Committee of the ASTE will accept technical papers to be presented to the semi-annual meeting in September 1959. Send outlines to: L. S. Fletcher, Program Director, American Society of Tool Engineers, 10700 Puritan Ave., Detroit 38, Michigan.

Foamed Metal—A new metal called F-Alloy that resembles a petrified sponge and is nine times lighter has been developed by General Electric's Flight Propulsion Laboratory at Cincinnati, Ohio.

Metal Alloys—A new metal alloy process which involves "mixing" ceramic materials with metals, thereby making the metal alloys three to four times as strong as conventional metals at high temperatures, has been developed by scientists at Denver Research Institute, University of Denver, in Colorado.

Metallurgy Courses—The metallurgical engineering department, New York University, College of Engineering, will present four programs primarily intended for practicing engineers during the summer of 1959. For detailed information write to: New York University, Office of Information Services, Washington Sq. Center, New York 3, N. Y.

Research Employment—A document pointing out various ways whereby British graduates can obtain research employment in the United States has been prepared by D. B. Hunter and may be obtained by writing to the American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio.

Bonding Process—"Ball Bonding", a new technique in the bonding of aircraft components has been announced by Twin Coach Co. of Buffalo. This new method eliminates voids by providing a completely uniform application of pressure.

New Corporation — Mallinckrodt Chemical Works, pioneer uranium fuels processor in this country, has established the Mallinckrodt Nuclear Corp., a wholly-owned subsidiary, that will take over the facilities and personnel of the Mallinckrodt Special Metals Division.

New Standards—ALLOYD Research Corp., 202 Arsenal St., Watertown, Mass., has announced a new series of standards for use in analysis of nickel, chromium and manganese in 400 series stainless steels. As a result of the excellent sensitivity of X-ray florescence analysis technique extreme control of composition and metallurgical structure of the standards were required. It is now possible to supply standards with composition known to ± 0.03 wt. %.

CHAPTER MEETING CALENDAR

Akron	**Mar. 18**	Sanginiti's		Guided Missiles
Albuquerque	**Mar. 19**		**J. A. Fellows**	Metallurgy of Uranium
Baltimore	**Mar. 16**	Engineers Club	**Dr. McPherson**	Standards for Industry
Boston	**Mar. 6**	M.I.T. Faculty Club	**S. G. Fletcher**	Dimensional Changes in Steels Influenced by Microstructure
British Columbia	**Mar. 11**	Stanley Park	**C. H. Lorig**	Selection of Materials
Calumet	**Mar. 10**	Phil Smidt	**R. W. Gardner**	Cold Extrusion of Steel
Canton-Massillon	**Mar. 3**	Mergus Restaurant		Automatic Gas Turbines
Carolinas	**Mar. 4-5**		**H. W. Cook**	Equipment for Materials Testing
Chicago	**Mar. 9**	Furniture Club of America	**Edward Jones**	Turbojet Metallurgy
Chicago-Western	**Mar. 16**	Old Spinning Wheel	**George Clark**	Patent Law
Cincinnati	**Mar. 12**	Engineering Society	**John Fisher**	Transformation Kinetics
Cleveland	**Mar. 3**	Engineering Society	**F. G. Tatnall**	Is Testing Necessary?
Columbia Basin	**Mar. 5**		**C. H. Lorig**	Brittle Failures of Metals
Columbus	**Mar. 4**	Broad St. Christian Church	**W. C. Troy**	Fiber Metallurgy
Dayton	**Mar. 11**	Engineers Club	**J. C. Fisher**	Transformation Kinetics
Delaware Valley	**Mar. 18**		**D. L. McBridge**	New Developments in Steelmaking in Europe
Detroit	**Mar. 9**	Rackham Memorial Union	**J. Y. Riedel**	Improving Production With Tools and Dies
Eastern New York	**Mar. 10**	Panetta's Menands		Geisler Award Lecture
Fort Wayne	**Mar. 9**	Hobby Ranch House	**E. J. Pavesic**	Heat Treatment of Toolsteels
Golden Gate	**Mar. 9**	Spenger's Fish Grotto	**E. R. Parker**	National Officers Night
Hartford	**Mar. 10**	Indian Hill Country Club	**J. J. Buchinski**	Cladding of Metals
Indianapolis	**Mar. 16**	Village Inn	**N. O. Kates**	Minimizing Heat Treating Distortion
Inland Empire	**Mar. 4**		**C. H. Lorig**	National Officers Night
Kansas City	**Mar. 18**	Golden Ox	**A. S. Doty**	Powder Metallurgy
Lehigh Valley	**Mar. 6**	Hotel Traylor	**Donald Hilty**	Automation
Long Island	**Mar. 18**	Patricia Murphy's	**G. L. Kehl**	New Approaches to Metallography and Microscopy
Mahoning Valley	**Mar. 10**	Mural Bldg.	**J. F. Beale**	High-Carbon Rimmed Steel
Miami	**Mar. 9**	Edith & Fritz Restaurant	**H. Voegeli**	Architectural Uses of Copper and Its Alloys
Milwaukee	**Mar. 17**	American Serbian Hall	**Panel**	Review of Current Welding Processes
Minnesota	**Mar. 25**	Rochester, Minn.	**Tour**	I.B.M.
Montreal	**Mar. 2**	Queen's Hotel	**H. W. Carlisle**	Cold Forming
Muncie	**Mar. 10**	Ball State Students Center	**J. D. Graham**	Field Failures as Influenced by Heat Treatment and Machining
New Jersey	**Mar. 16**	Essex House	**R. J. Raudebaugh**	High-Temperature Application of Stainless Steel
New York	**Mar. 2**	Brass Rail Restaurant	**R. H. Aborn**	Toughness Without Tempering
North Texas	**Mar. 5**		**Cornelius Johnson**	
Notre Dame	**Mar. 11**	Capri Restaurant	**R. S. Modjeska**	Chromium Plating
Oak Ridge	**Mar. 18**	K of C Hall		
Ontario	**Mar. 6**	King Edward Hotel	**Social**	Ladies Night
Penn State	**Mar. 10**	Mineral Sciences Auditorium		Metallurgy of Nuclear Fuels
Philadelphia	**Mar. 20**	Franklin Institute	**Morris Cohen**	Role of Metal Structure in Behavior of Steel
Philadelphia-Jr. Section	**Mar. 4**			Plant Tour
Purdue	**Mar. 17**	Danville, Ill.	**Tour**	Central Steel Foundry
Richmond	**Mar. 11**	Reynolds Metals Co.	**Tour**	Extrusion Plant
Rochester	**Mar. 9**	Manger-Seneca Hotel	**R. V. Vanden Berg**	Aluminum Finishing Techniques
Rockford	**Mar. 25**	Hotel Faust	**A. E. Focke**	Nuclear Power for Aircraft Propulsion
St. Louis	**Mar. 19**	Ruggeri's Restaurant	**R. J. Gray**	Metallography and Its Contribution to Metallurgy
Saginaw Valley	**Mar. 12**	High-Life Inn	**K. Speiser**	Welding of Nickel and High-Nickel Alloys
Santa Clara Valley	**Mar.**		**Earl Parker**	
Savannah River	**Mar. 12**		**W. D. Manly**	New Reactor Developments
Southeast Ohio	**Mar. 5**		**John Rutherford**	Steels for High-Temperature Applications
Southern Tier	**Mar. 9**	O'Brien's Restaurant	**H. W. Northrup**	Heat Treatment and Properties of Alloyed Cast Iron
Springfield	**Mar. 16**	Chalet	**J. K. Nyburg**	Powder Metallurgy
Syracuse	**Mar. 3**	Onondaga Hotel	**L. D. Richardson**	Materials—Key to Air Superiority
Texas	**Mar. 3**	Engineers Club	**G. A. Fisher**	New Concepts of Alloy Steels and Their Heat Treatment Properties
Toledo	**Mar. 12**	Maumee Yacht Club	**F. Rote**	Modern Graphitic Cast Irons
Tulsa	**Mar. 3**	Alvin Hotel	**W. J. Barnett**	Delay Failure and Hydrogen Embrittlement in High-Strength Materials
Utah	**Mar. 18**	Panorama Inn	**M. A. Orehoski**	Effect of Vacuum Steam Degassing on Properties of Forging Steels
Washington	**Mar. 9**	Dodge Hotel	**A. H. Peterson**	New Developments in the Forming of Metals
Western Ontario	**Mar. 13**	Windsor		Cold Extrusions, Tooling and Processing
West Michigan	**Mar. 16**	Schnitzelbank Restaurant	**L. D. Richardson**	New Developments in Welding
Wilmington	**Mar. 11**	Sammy Green's Restaurant	**M. A. Schell**	National Officers Night
Worcester	**Mar. 11**	Hickory House	**Paul Lowenstein**	Fabrication of Metallic Fuel Elements
York	**Mar. 11**	Lancaster	**D. J. Gilman**	Dislocations—Fracture and Plastic Flow

EMPLOYMENT SERVICE BUREAU

The Employment Service Bureau is operated as a service to members of the American Society for Metals and no charge is made for advertising insertions. The "Positions Wanted" column, however, is restricted to members in good standing of the A.S.M. Ads are limited to 50 words and only one insertion of any one ad. Address answers: c/o A.S.M., 7301 Euclid Ave., Cleveland 3, O., unless otherwise stated.

POSITIONS OPEN

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GRADUATE SALES METALLURGIST: Preferably with heat treating and laboratory experience, to handle well-established line of equipment in Southeastern Massachusetts and Rhode Island area. Good income possible, with future unlimited. Box 2-5.

NUCLEAR FUEL RESEARCH: Large, progressive company with expanding metallurgical laboratory requires a group leader, Ph. D. preferred, with research and development experience in nuclear and fabrication metallurgy and supervisory experience. Also engineers with up to four years experience in mechanical metallurgy, welding, brazing, melting and fabrication. Desirable New England location. Relocation expenses paid. Box 2-10.

Naval Air Material Center engaged in extensive program of aeronautical research, development, experimentation and test operations for advancement of Naval aviation needs metallurgists (salaries $4490 to $9530 per year) for work on high-strength steels, precision castings, heat resistant alloys, oxidation resistant coating for molybdenum, inert and shielded metal arc and resistance welding. Positions include research, development and evaluation-type duties. Interested persons should file Application for Federal Employment, Form 57, with Industrial Relations Dept., Naval Air Material Center, Naval Base, Philadelphia 12, Pa.

METALLURGIST: Experienced in stainless and high-temperature alloys as castings and forgings. Application of these materials to hot working dies in glass industry. Take complete charge of metal development and applications program. Welding experience desirable. Small metallurgical department in large well-known glass company. Minimum B.S. in metallurgy required, preferably 3 to 8 years experience in related fields. Supervisory potential wanted. Box 2-15.

Midwest

FELLOWSHIPS AND RESEARCH ASSOCIATESHIPS: For advanced work leading to a doctoral degree in physical metallurgy. Course work offered in kinetics, thermodynamics, physics of metals, nuclear metallurgy, theory of alloying and X-ray diffraction. Research facilities available. Deadline for applications Mar. 1, 1959. Write: Dept. of Metallurgy, University of Denver, Denver 10, Colo.

METALLURGIST: Stainless strip. With 5 to 8 years experience. Laboratory and cold rolling background essential. B.S. degree in metallurgy or metallurgical engineering. Ohio location. Salary commensurate with experience. Send resume of experience and salary requirement. Qualified applicants will be invited for personal interview. Box 2-20.

METALLURGIST: Graduate metallurgist familiar with laboratory testing and experience in planning and supervising metallurgical investigational work. Background in applying metallurgy to shop problems necessary. Position is concerned with investigation of titanium materials and application of these findings to actual manufacturing; therefore, experience in titanium metallurgy is very desirable. Submit resume and salary requirements to: Employment Office, Solar Aircraft Co., 1901 Bell Ave., Des Moines, Iowa.

CHIEF METALLURGIST: Ball-bearing company has opening for graduate metallurgist with a minimum of five years experience in industry. Full responsibility for metallurgical control of product operations and development of new processes in ferrous metallurgy involving carburizing, heat treating and testing of carbon and alloy steel. This is an excellent position in a growing company and industry for man between 30 and 45 years of age. Send resume. Box 2-25.

METALLURGIST: For bearing company in Detroit in research and development department. Must have degree and be capable of working on problems in metallurgical control of product operations and development of new processes in ferrous metallurgy involving carburizing, heat treating and testing of carbon and alloy steel. Prefer laboratory, testing and metallography experience in metals industry since graduation. Age 27-35. Submit resume with complete details. Box 2-30.

PHYSICAL METALLURGIST: B.S. degree in metallurgical engineering with minimum of five years experience in field of physical metallurgy. Experience in metallography and heat treatment desirable. Position involves supervising programs concerning heat treating of uranium, metallography and evaluation of fabrication processes. Send complete resume to: National Lead Co. of Ohio, P. O. Box 158, Mt. Healthy Station, Cincinnati 31, Ohio.

RESEARCH METALLURGIST: Magnetic materials. Supervise and conduct research on special-purpose alloys such as electrical resistance alloys, controlled modulus alloys and

Notice of Change in Publication of A.S.M. Review of Metal Literature

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METALLURGIST, PHYSICAL: To work on challenging problems in development of rare earth alloys. Experience in nonferrous metallurgy or alloy development desirable. Contact B. Love at A.I.M.E. meeting, San Francisco, St. Francis Hotel, or write Research Chemicals Inc., Box 431, Burbank, Calif.

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CHIEF METALLURGIST: A modern, fully integrated aluminum plant desires experienced metallurgist to take charge of newly created department. Excellent, long-range opportunity. Three to five years experience desirable; if recent graduate, M.S. degree required. Age 25-35. Send detailed resume and expected salary in original correspondence. Box 2-40.

POSITIONS WANTED

METALLURGICAL ENGINEER: Presently employed in metallurgical research work. Has 20 years experience, including metal processing, physical metallurgy and powder metallurgy. Familiar with high-temperature and refractory metals. Will consider research, sales engineering, contact work or production. Midwest location first choice. Box 2-45.

METALLURGICAL ENGINEER: B.S. degree. Four years experience, two in production and development includes openhearth building, melting and steel rolling and melting and fabrication of nickel-base alloys; two years in metallurgical laboratory includes alloy development on high-strength steels. Veteran, family, age 27. Desires responsible position in development or quality control. Box 2-50.

PHYSICAL METALLURGIST: Ph. D. degree. Seven years industrial metallurgical experience, past four years as chief metallurgist for medium-size producer of aluminum and brass castings. Interested in castings metallurgy and alloy development. Seeks responsible position with medium-size nonferrous company in the South. Box 2-55.

PHYSICAL METALLURGIST: M.S. degree. Four and one-half years research and development experience, two years transformations and mechanical properties of steels, two and one-half years elevated temperature research dealing with oxidation, creep, corrosion problems, etc. Desires to start in other fields such as welding, powder metallurgy, fabricating, etc. Eastern U. S. or Midwest preferred. Box 2-60.

INSTRUMENTAL ANALYST: B.S. degree in chemistry, married, family, veteran. Eight years experience in all phases of emission spectrography, alloy analysis, trace elements in organics and metals, methods development, direct reading and photographic, etc. X-ray diffraction and fluorescence. Some work with electron microscope and infra-red. Desire more responsible position, preferably in New Jersey area. Box 2-65.

WELDING AND MANUFACTURING ENGINEER: M.S. degree, age 35, family. Strong background in heavy metal fabrication, including nuclear power equipment. Experienced in all types of welding processes, development of manufacturing methods, quality control, ferrous and nonferrous metallurgy. Prepared specifications and advised design engineering personnel. Desires responsible supervisory position. Box 2-70.

METALLURGICAL ENGINEER: Graduate metallurgical engineer, to receive M.S. degree in industrial administration, Carnegie Tech, June 1959, interested in small to medium-size company desiring to add engineer with extensive management training in production, finance, linear programming and administrative practices to its staff. Experience includes 18 months in metallurgical development work, two years armed services. Age 26, married. Box 2-75.

MANUFACTURING OR PLANT MANAGER: In metal processing or fabrication industry. M.S. degree in production management. Twelve years experience in manufacturing, metal research, administration, personnel and central staff manufacturing engineering. Successful product design and production record. Skilled in metal processing, methods planning and evaluation. Age 37. Midwest preferred. Box 2-80.

METALLURGIST: M.S. degree, age 35, family. Nine years experience in basic and applied research. Well-rounded background in physical and mechanical metallurgy. Publications. Bulk of experience in X-ray diffraction, phase diagrams, vacuum techniques and titanium. Project supervision. West Coast. Box 2-90.

ELECTROCHEMIST-METALLURGIST: Corrosion specialist, widely experienced. Supplementary background in metal finishing and plastics. Bachelors and advanced degrees. Presently laboratory supervisor. Seek more responsible position. Reply: Box 6002, U. S. Post Office, Philadelphia (14), Pa.

Swiss manufacturer of custom tungsten carbide tools and dies (powder metallurgy process) seeks contact with American aluminum and brass fabricators. Contact: CARDURO, Dr. M. Villat, *Aarau*, Switzerland.

KAPL Physicist Rudolf E. Slovacek working with Laboratory-Developed Time-of-Flight Analyzer. The graphs he is holding show neutron spectra curves obtained from data provided by the new Analyzer. This compact instrument fits into one 10-inch chassis.

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Rudolf E. Slovacek is one of a number of KAPL scientists concerned with reactor physics. He earned a BSEE at Union College in 1945, joined KAPL in 1951 after taking his MS in Physics at Indiana University. Since then he has contributed to several KAPL projects.

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...ility After pulling the tensi... ...men to the point of ru... ...oken ends are removed from ...achine and carefully fitted t... ...means of a caliper and scal... ...that the specimen has perma... ...tically elongated can be dete... ...Fig. 1:7. This mea... ...the gage length (...stamped on ...pulling...

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- ☐ Electroplating
- ☐ Magnesium
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Michigan	Detroit	Broadway 3-5405
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Missouri	St. Louis	Jefferson 3-3025
	Kansas City	Jefferson 1-5213
New York	New York City	Dewey 8-3311
	Buffalo	Delaware 7878
	Syracuse	Howard 3-2748
	Binghamton	4-7703
	Farmingdale, L. I.	Chapel 9-6303
Ohio	Cincinnati	Plaza 1-1434
	Cleveland	Broadway 1-1100
	Lyndhurst	Hillcrest 2-5625
Pennsylvania	Pittsburgh	Gibsonia: Hilltop 3-3793
Texas	Arlington	Crestview 4-3331
Washington	Tacoma	Juniper 8-0344
Wisconsin	Elmgrove	Sunset 6-5400

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204	Pressure Nitriding
205	Industrial Furnaces
206	Austempering-Martempering
207	Radivection, Electric-Gas
208	Leasing Equipment
209	Instantaneous Heat
210	Conveyor Systems for Heat Treating & Plating